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AUGUST 1938

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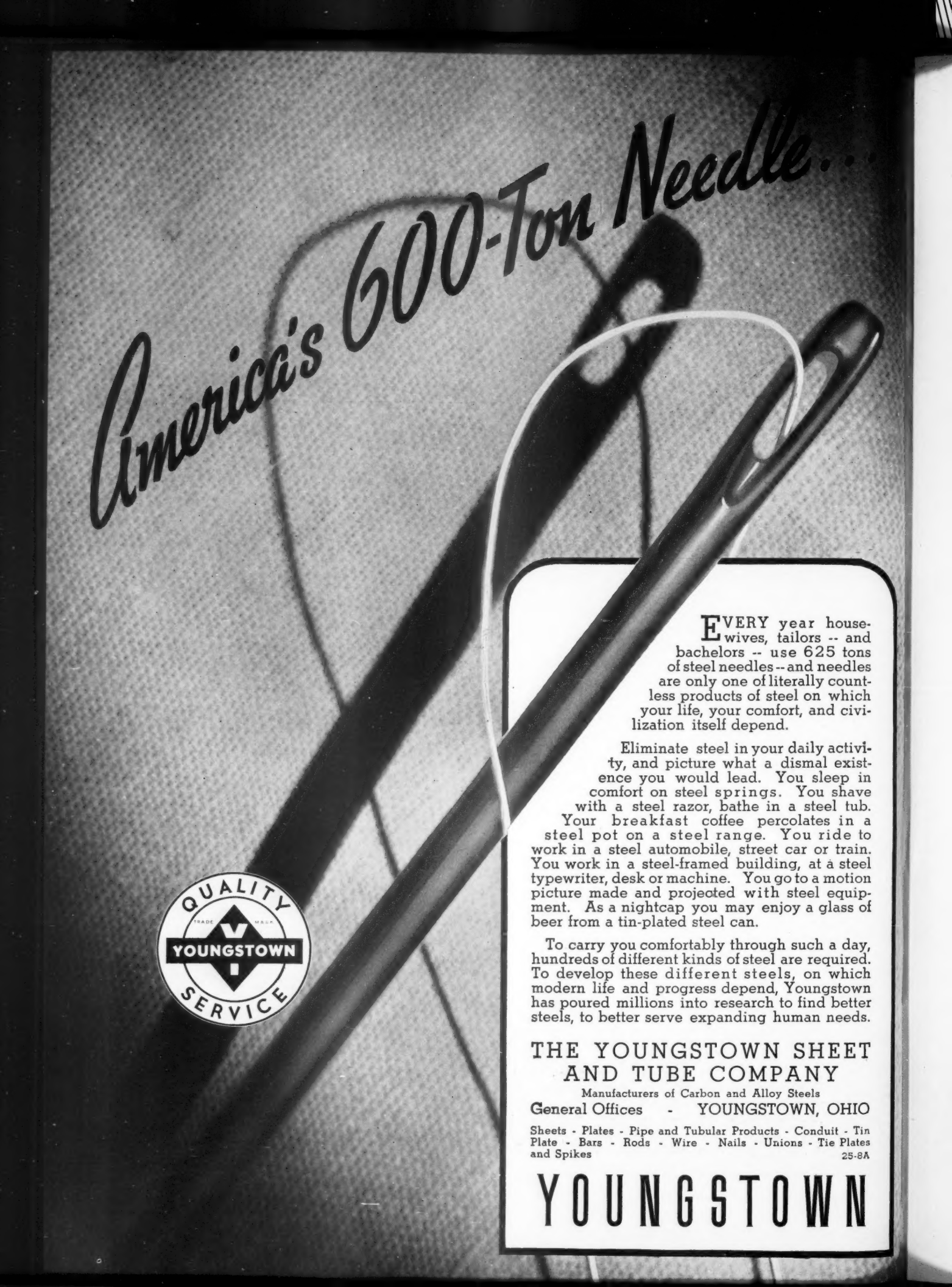
OFFICIAL PUBLICATION OF THE WIRE ASSOCIATION



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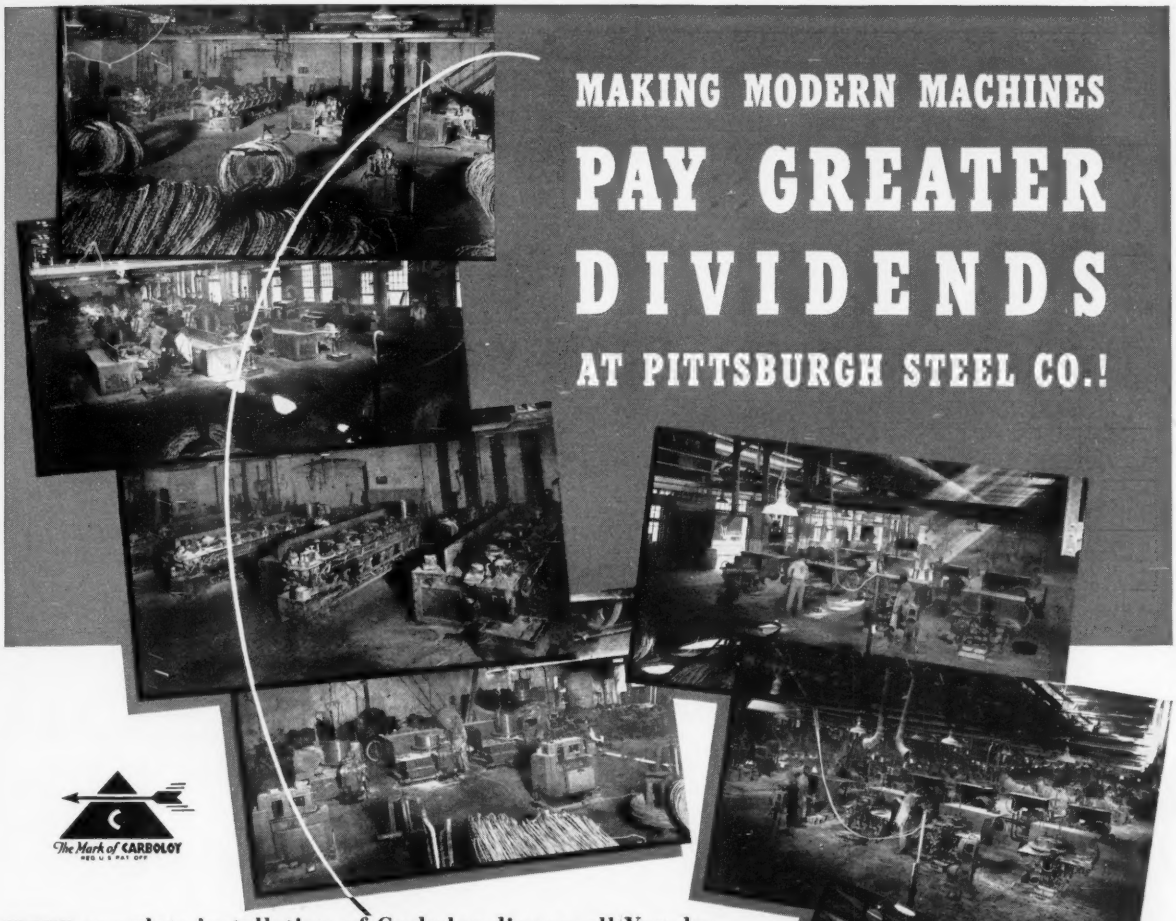

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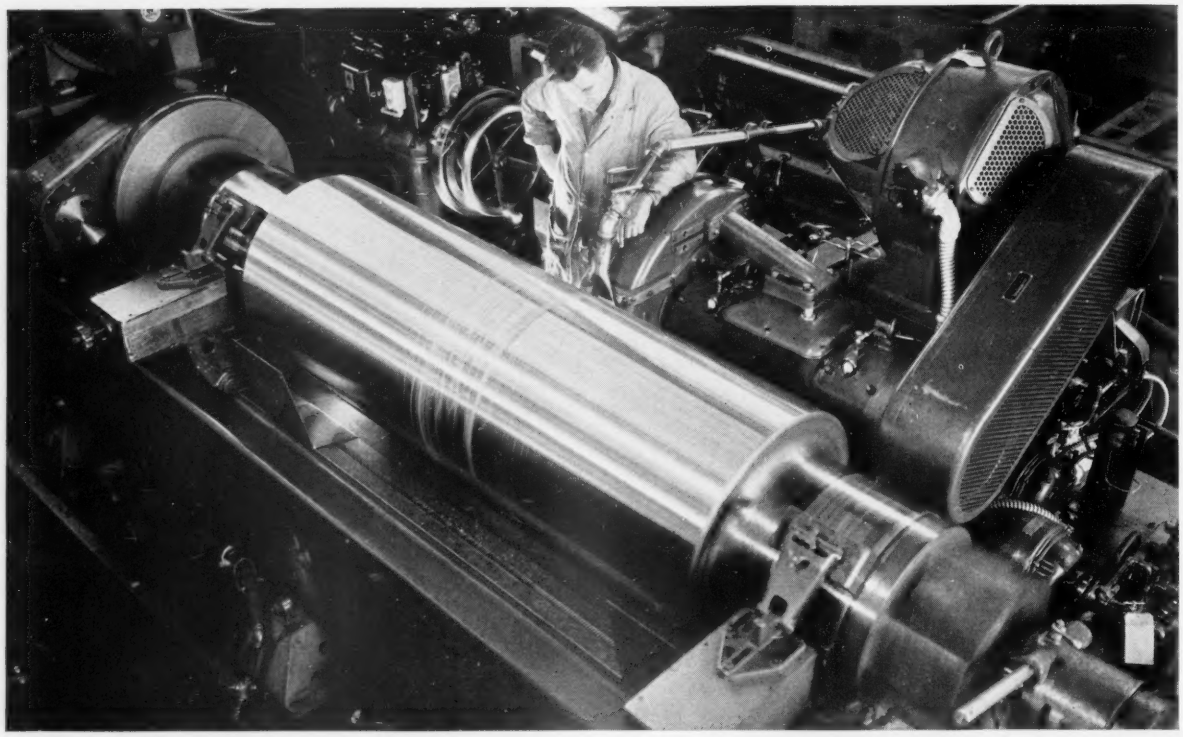

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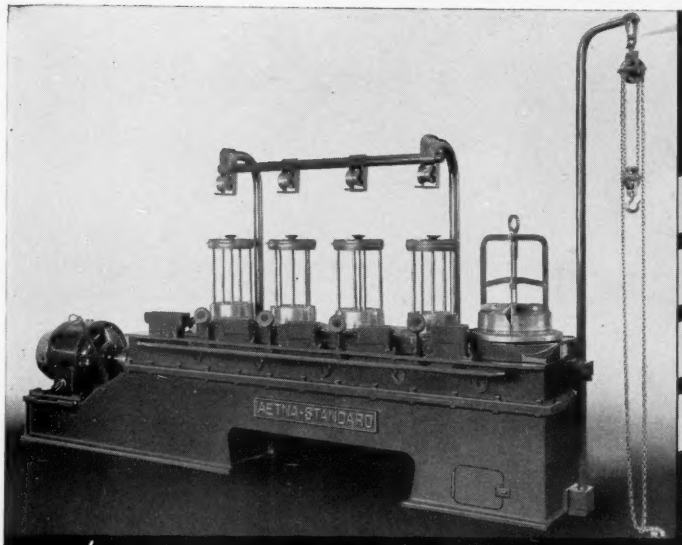

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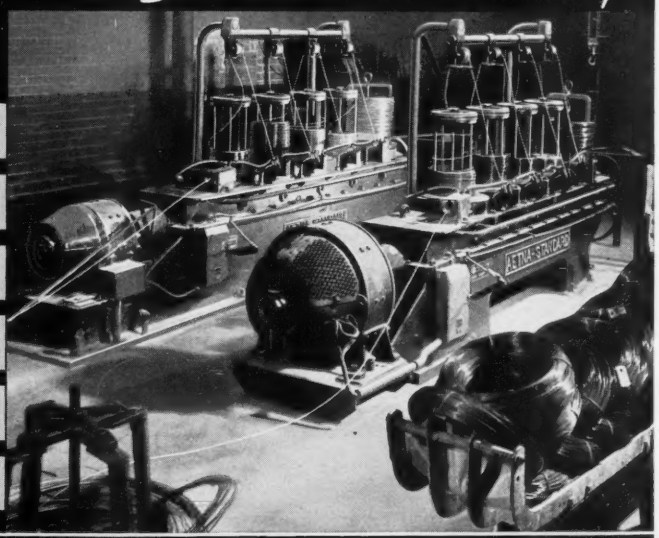

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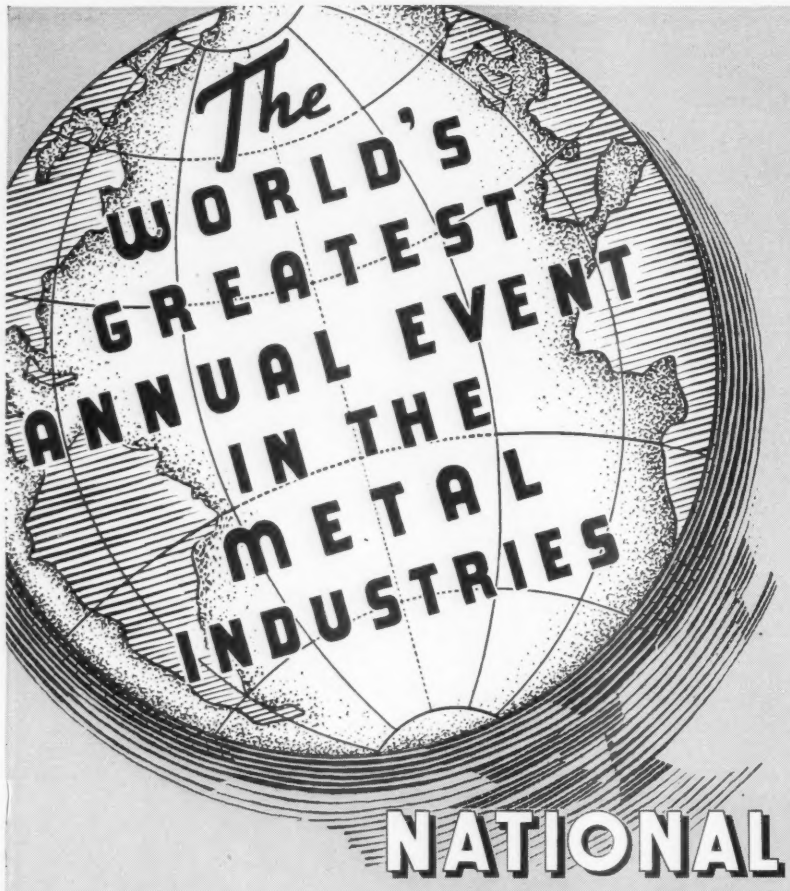

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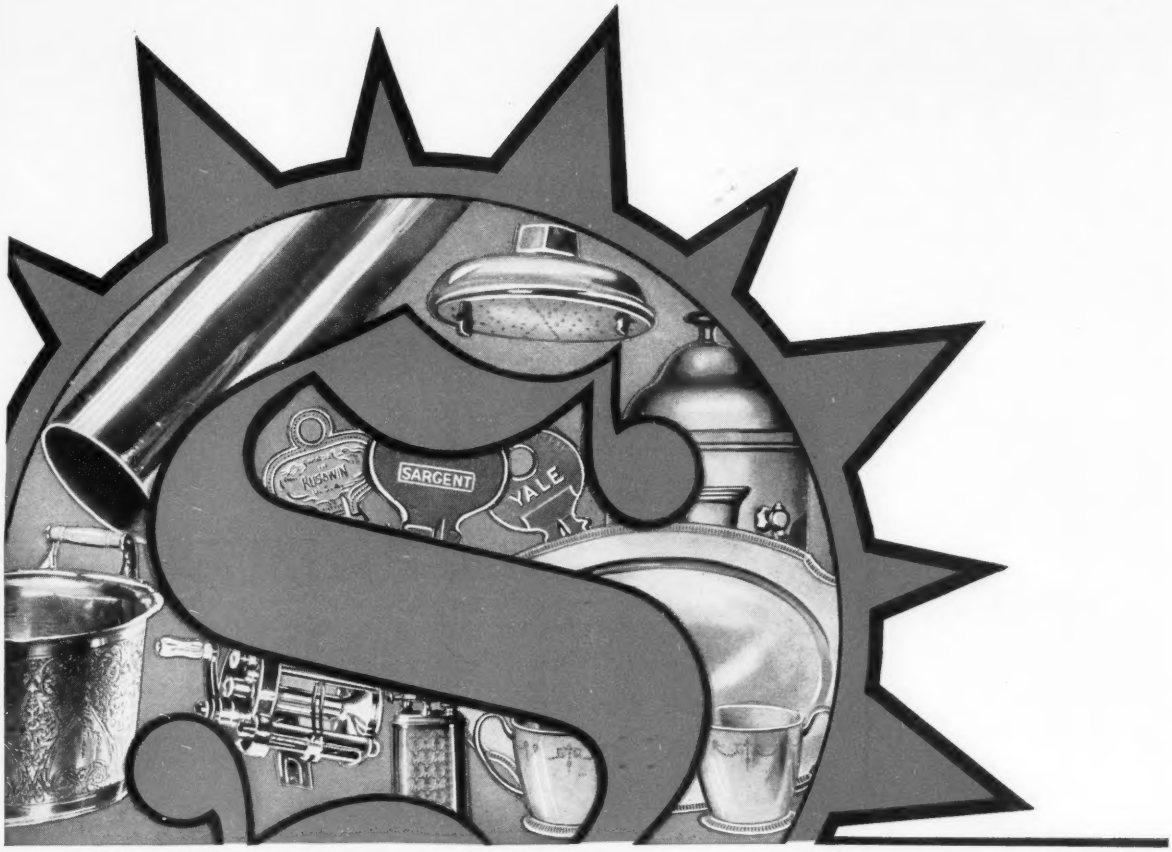

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For sixty years, The Seymour Manufacturing Co. has supplied Nickel Silver to the manufacturers of silverware, metal goods, keys, scientific instruments, and a wide bracket of miscellaneous items. To these consumers, "Seymour" is headquarters for this versatile alloy.

Seymour Nickel Silver is furnished in sheet, wire and rod, all standard gauges. Enumeration of its qualities suggests its many uses—information of value to all Purchasing Agents:

It is highly corrosion resistant, and is, therefore, excellent for moving parts that must function in damp conditions.

Because of its silvery white color, it is the preferred base for plated silverware.

Any degree of hardness can be given it, from dead soft to resilient spring. In its ductile stages, it is ideal for spinning and drawing, as it requires relatively few anneals, sometimes none! In its hardened stages, it is used for flat and coiled springs for special needs not adequately met by rustable metals.

It can be leaded for easy machining. For this, it is supplied frequently in 18% rod—a Seymour specialty for many years.

Sketchily, this is the story of Seymour Nickel Silver. If your shops would like to try it out in some part of a product you are making, we shall be glad to send test samples without obligation.

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NEW YORK CITY

WIRE AND WIRE PRODUCTS

A monthly publication devoted to the production of Wire, Rod and Strip, Wire and Rod Products and Insulated Wire and Cable

DRAWING—ROLLING—EXTRUDING—FORMING—FABRICATING

Vol. 13 AUGUST, 1938 No. 8

Designated as

Official Publication By The Wire Association

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A monthly publication devoted to the production of Wire, Rod and Strip.
Wire Products and Insulated Wire and Cable.
DRAWING --- ROLLING--- EXTRUDING --- FORMING --- FABRICATING

Vol. 13 AUGUST, 1938 No. 8

Selling American Machinery In Europe

By James Day, S. E.,
Selson Machine Tool Co. Ltd.,
London, England

Some of the difficulties encountered in selling American machinery in Europe briefly described. ✦ ✦ ✦ ✦ ✦

IT may be difficult for American Manufacturers to sometimes understand the ways of we Europeans when we appear to react so unfavourably to their apparently very excellent sales propaganda. No doubt such propaganda is eminently suited to the United States of America mentality.

✦ ✦ ✦

HOWEVER, twenty years of experience has given the writer a somewhat mellowed view, but our American friends can rest assured that there is really something to be said for our apparent sales resistance.

✦ ✦ ✦

IN America you have a vast country composed of a number of States which generally speaking operate under similar conditions and therefore the same sales propaganda can be adopted universally, whereas here in Europe each Country requires a different technique and study in accordance with its psychological and industrial make-up. This is not quite so difficult as it may sound, but does nevertheless play some part in the successful selling of American equipment.

✦ ✦ ✦

IN Great Britain one would naturally think that we should be very similar to America and consequently the American methods could be used more easily here than anywhere else, but that is not true. Probably the Countries where American methods could most easily be used would be Scandinavia where many of the engineers are American trained and also the economic conditions more nearly resemble those of the United States of America.

JAMES DAY

After spending some time as Engineer in the Cable Works of Messrs. Connolly Bros. of Manchester, joined the Selson Machine Tool Co. Ltd., of London as sales engineer and since 1919 has been representing various American companies in the sale of their equipment throughout Europe.

✦ ✦ ✦

IN the British Isles our psychological make-up and our economic conditions both play a big part in producing a type of sales resistance which is difficult for Americans to understand.

✦ ✦ ✦

IN the British Isles the initial cost is very often the first and most important consideration. We have been cradled for generations in the theory that in England we make things to last and whether this is good policy or otherwise is not the point and we must realize it is still there in our make-up.

✦ ✦ ✦

IN addition to this there is a general tendency also to "make things last," apart altogether from "making things to last" which is quite a different matter.

✦ ✦ ✦

WE in England are not allowed to depreciate plant so rapidly in our balance sheets and consequently we are more or less compelled to make them last. This will probably be changed in the near future as the Government in the 1938/9 budget propose changing the income tax allowance for depreciation of equipment to five years.

Designated as Official Publication by the Wire Association

THE writer remembers during one of his visits to America, seeing a certain type of machine operating in a plant at about 50% higher speed than the highest speed we ever operate over here in Europe. On asking how long they expected the machine to last he was informed about three years. On the other hand we have customers here in Britain using similar machines which are over twenty years old and which have for ten years been operating at somewhat higher speeds, yet to suggest replacement to such customers would be unheard of.

✦ ✦ ✦

THIS equipment is operating quite successfully and efficiently under the present economic conditions prevailing in England where such a volume of production is not required.

✦ ✦ ✦

WE have to remember that in England our basic labour costs are about half of those in U. S. A. so that the urge to reduce labour costs by increased speed and newer and better equipment is not so strong as in U. S. A. These general conditions do not apply to all other European Countries each having its own psychological make-up and economic conditions.

✦ ✦ ✦

IN Holland the conditions are to some extent similar to the Scandinavian Countries and they are generally anxious to have the latest equipment which is probably accounted for due to the fact that their wage basis is higher than in Britain and therefore they are more concerned about labour saving equipment.

✦ ✦ ✦

IN France and Italy you meet quite different problems again. The French require more personal attention and perhaps take longer to come to a decision whereas in England the customer generally carefully decides what he wants, sends out definite enquiries and then considers each proposal thoroughly, probably sees a representative from each company putting forward propositions to discuss their particular proposals and after that it is little use trying to make further calls to influence the business because a decision will be made and settled definitely and quickly and any attempt to make further contact once you have given them all the information they require is likely to react unfavourably. Notwithstanding this general attitude, however, the writer is ready to admit that even in England production engineers are always ready to consider improved methods and machinery and occasionally sales are effected by such propaganda.

✦ ✦ ✦

IN France, Italy and Belgium it is necessary to spend much more time with customers before decisions are arrived at.

✦ ✦ ✦

THE writer had an experience in Italy where we started discussion on a certain proposal which continued over three days, the amount involved was not very large, but we discussed the technical points, then the financial points and all through the discussion they had their accountants present who carefully checked the weight of the equipment against the price, apparently without any consideration as to the machine work contained in the equipment so much so that it did occur to the writer that he wished he had been selling heavy machinery instead of small delicate equipment.

THERE is also in Italy and in Holland a tendency to always expect appreciable discounts or reductions from the price quoted and often discussions on price reductions are more difficult than on technical matters.

✦ ✦ ✦

RUSSIA and Germany are of course different problems again and under present conditions of exchange restrictions, quotas, etc., selling not only in the above countries but in a good many European Countries is extremely difficult.

✦ ✦ ✦

THESE difficulties are such that even the finest sales propaganda in the world is unable to overcome.

✦ ✦ ✦

IN conclusion one experience in Norway may be interesting. A certain customer in Oslo was visited and for the first time in Scandinavia it turned out there was nobody available at this particular plant able to speak English. The director refused to wait for an interpreter and we settled down to discuss the merits of our machinery compared with competitive machinery by making sketches on paper showing the relative production, floor space, cost, etc., on each type of unit and by using the two words "good" and "bad." Finally this director wrote on a piece of paper "I order 25 'stuck'." Fortunately the writer understood 'stuck' meant pieces. This is of course an unusual type of sales propaganda but the writer frankly confesses the machinery he was selling was such that it absolutely lent itself to sales propaganda of the above nature being successful in spite of the difficulty of not being able to speak one another's language.

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At DETROIT, MICH. OCTOBER 17th to 21st, 1938

There Will Be A Registration Fee of $5.00

Admission will be by Badge Only

Woven Wire Products

By R. M. Richter,

The California Wire Cloth Corporation, which weaves a great variety of woven wire products like textiles, uses gas in all operations involving heat, with constant, satisfactory results.

IN 1859, ten years after the first gold rush, the California Wire Works in San Francisco, now the California Wire Cloth Corporation, began operations which have continued actively and on an expanding scale ever since. From modest beginnings this company has progressed to its status of today, with a plant at Oakland covering 13 acres and employing 260 men. The annual payroll is about $500,000. All operations involving heat are serviced with natural gas from the lines of the Pacific Gas and Electric Company. A complete change over to gas was made in 1931, with constant, highly satisfactory results.

✦ ✦ ✦

"CALWICO," the company's trade name, weaves wire like textiles. Ponderous wire netting machines click rhythmically as bobbins feed shuttles and shuttles lace and interlace wire, heavy or light, as if it were finely spun wool. The result is a perfect product, whether industrial screen woven of 1-in. rods with 12-in. openings or screen with a mesh so fine that the openings cannot be penetrated by a human hair. The wire stock comes largely from the company's San Francisco wire-drawing mill and may be iron, steel, aluminum, brass, copper, bronze, nickel, monel or whatever metal specification has been found most suitable by experience for a given purpose.

THIS great variety of woven wire products serves for industrial screens for mines and crushed rock plants, poultry netting, stucco netting, netting for the salmon catch, cooling towers, store-room and partition screens, cages, refrigerator cars, dehydrators, brick and tile anchorage, concrete reinforcing, locker rooms, well casings, oil filters, washing machines—in fact any specification for woven wire in any use can be met. The company says: "You Name It—We Weave It."

✦ ✦ ✦

"CALWICO" hardware cloth commands an especially wide distribution. Industrial plants use it for machinery guards, tool cribs and "parts" departments, miners equip their sluice boxes with it and greenhouses employ it for protection against hail. Twenty miles of hardware cloth, heavily galvanized, overlaid the chain link catwalk used in the construction of the San Francisco-Oakland Bay Bridge, the cloth giving the workmen a secure footing and precluding the dropping of small materials and tools below.

✦ ✦ ✦

WHEN you prepare to pay the attendant the toll charge on this bridge, and the day is dry and warm, static sparks are likely to jump from the motorist's hand to that of the collector. The resultant, involuntary jerk from this electrifying contact causes innumerable coins to drop through the steel grate in the paving and into the oil sump beneath. Even if recovered, this formerly involved a time consuming, noxious effort. So "Calwico" galvanized wire cloth was installed below the steel grates and the trouble of recapturing "statically lost" money was minimized.

✦ ✦ ✦

GALVANIZING is done after weaving. First the finished web is pickled twice in an acid bath for cleaning, then is fed automatically to the galvanizing tank, then through a sal-ammoniac bath floating on zinc and, finally, through a bed of charcoal which wipes the netting clean. Fig. No. 1 shows the netting coming up through the charcoal bed and Fig. No. 2

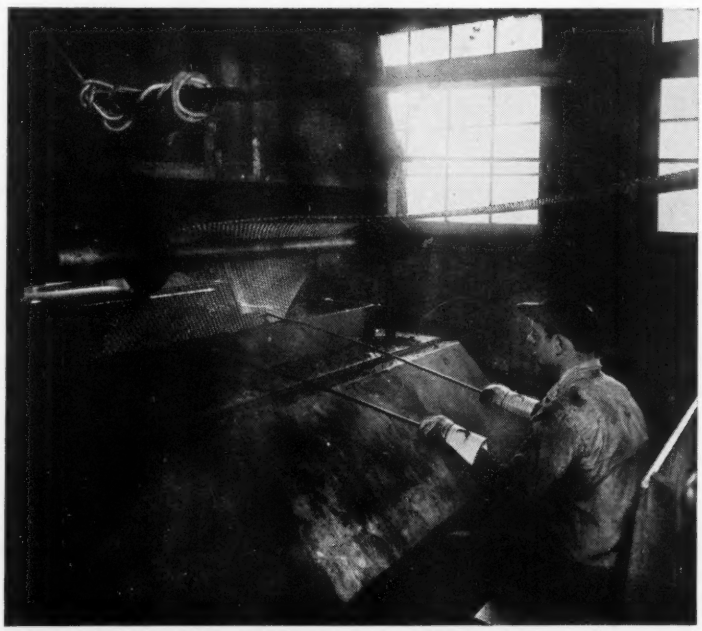


Figure 1 shows the netting coming through the charcoal bed.

✦ ✦

illustrates the finished product being rolled ready for the warehouse.

✦ ✦ ✦

IN the galvanizing installation the "V" bottom kettles are of special locomotive fire box steel from the Alameda, Calif., plant of the Bethlehem Ship Building Corporation. The two larger kettles are eight ft. long, 40 in. wide and 30 in. deep. They weigh two and one-half tons and are bedded on Johns-Manville C-3 cement, with Johns-Manville silocel for insulation outside the fire brick lining.

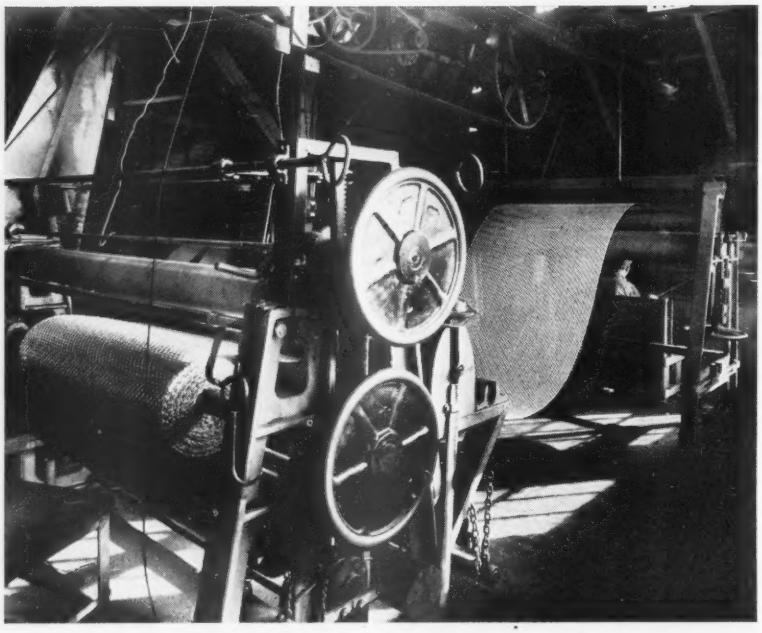


Figure 2. Illustrates the finished product being rolled ready for the warehouse.

✦ ✦ ✦

THE plant is served with natural gas averaging 1100 B.t.u.'s through an American Meter Company meter rated at from 3000 to 6000 cu. ft. per hr., with standard pressure regulator.

✦ ✦ ✦

EVERY feature of this meter installation is fully by-passed. If the regulator requires adjustment, it can be by-passed through the meter. If the latter demands attention, it also can be cut out without interrupting operations, or, both meter and regulators can be by-passed simultaneously when being serviced.

✦ ✦ ✦

IN the zinc galvanizing bath the heat control is automatic by thermocouples, with duplicate piping on opposite sides of the kettles. The firing equipment consists of two No. 56 inspirators for main burners and four No. 52 burners, the latter burning at all times for holding fires when operations are interrupted. These No. 52 burners are also used alone on very light cloth. Surface Combustion Company furnished all burners.

✦ ✦ ✦

THE flame impinges on beds of broken lumps of carborundum placed in fire brick pockets, causing the carborundum to glow white hot, heat transmission being chiefly by radiation, in part by convection, a scheme used by permission of the Surface Combustion Company.

✦ ✦ ✦

FIG. 3 is an instruction sheet prepared for the operators of the galvanizing equipment after erection, ready to run. It spots the source when the automatic controls indicate trouble. The thermocouple installation was designed and put in place by Plant Engineer J. W. DePoy. Burners are high pressure type. Micromax temperature control is Leeds and Northrup. Galvanizing temperatures range from 820 to 860 deg. F. Under 820 deg. causes unsatisfactory galvanizing performance; over 860 deg. inclines the zinc to eat into the "V" kettle. The control chart reflects a very satisfactory heat curve, showing how perfectly great heat can be controlled within close limits with gas.

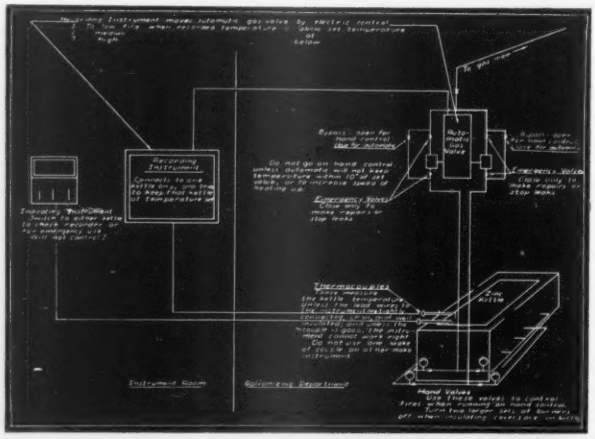


Figure 3 is an instruction sheet prepared for the operators of the galvanizing equipment after erection, ready to run. It spots the source when the automatic controls indicate trouble.

✦ ✦ ✦

THE large galvanizing units consume 800 cu. ft. of gas per hr. each, the smaller one 400. Gas is also used in this plant for electro plating window screens and similar work.

✦ ✦ ✦

MR. DePoy designed the thermocouple assembly. This consists of a ¾-in. inner container in which the thermocouple is housed. The whole is encased in a seamless steel tube which is replaced when it begins to deteriorate. Thus the inner container and the thermocouple proper are saved from destruction.

✦ ✦ ✦

THE entire equipment lay-out in respect to both operating units and gas installation represents the latest engineering development. A number of heavy machines were changed over by Mr. DePoy from the manufacturers' design and specifica-

(*Please turn to Page 419*)

COLD WORKING OF METALS FINISHED PRODUCTS

Cold Worked Metals + + + Cold Formed or Machined Products + + + Cold Heading

1. Metallurgy and Research
2. Processes and Machinery of Production
3. Cold Heading
4. Cold Forming and Finishing Operations
5. Extruding

Vol. 13 AUGUST, 1938 No. 8

Factors Affecting Grain Growth In Annealed Rivets

PART II

By R. W. Sandelin,

Metallurgist, Atlantic Steel Company, Atlanta, Georgia.

The objectives sought for in the annealing of low carbon rivets are varied but usually include the relieving of strain in the upset areas, the manufacture of a product having consistently uniform physical properties, or the softening of a rivet as a whole so that it may be more easily worked. Generally speaking, a rivet must be soft enough to upset easily and yet produce a union of sufficient strength. In any event, it is of interest to study the resulting structures and observe in what manner and to what degree these structures are affected by various modes of heating for annealing. Published in three parts. + + + + +

THE diagrams showing the various grain sizes in the different rivets were employed merely as the most convenient means of illustrating clearly the complete picture of each individual rivet. While the grain sizes are slightly exaggerated for clearness in the case of the finer grain sizes, those representing the larger sizes very nearly represent actual conditions in the rivet. A few photographs taken of the etched surfaces of rivets show a remarkable similarity to the diagrams. Figure 111 shows an actual photograph of a rivet coarsened under the head and point, and particularly so along the edges of the shank. The extremely coarse grains along the edge of the shank are easily distinguishable. Figure 112 shows another rivet of the same type in which the abruptness in grain size change is easily observed. Note the coarsened band under the head and also near the tip of the rivet. These photographs represent the rivets illustrated in Figures 71 and 72 in the preceding diagrams.

Figure 113 shows still another rivet of the same type with some degree of coarsening along the edges of the head.

+ + +

FIGURE 114 shows an actual photograph of an unannealed rivet direct from the rivet machine. Due to selective etching the greatly stressed areas show up in vivid contrast and reveal clearly the distribution of such stresses in the head and point of the rivet. This photograph represents the type of rivet illustrated in Figures 9, 35, 60 and 86 in the preceding diagrams.

+ + +

IN the preceding diagrams the various grain sizes have been designated as (1) very fine, (2) fine, (3) medium, (4) large, (5)

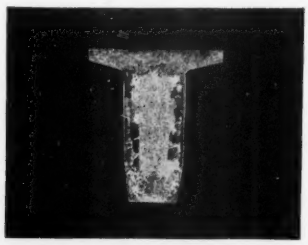


Fig. 111. Actual photograph of the etched surface of a rivet showing considerable coarsening along the edges of the shank. Coarsening also occurred under the head and in the point. Slightly enlarged.

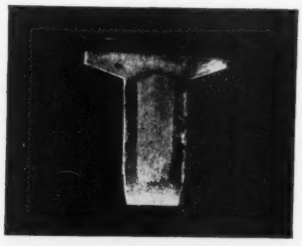


Fig. 112. Another photograph of a coarsened rivet showing the sharp distinction between the coarsened and unaffected areas. Note the coarsened band under the head. + + +

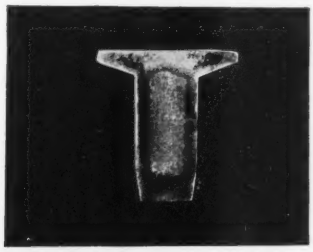


Fig. 113. The same type of coarsened rivet shown in Figs. 111 and 112. Note the slight coarsening along the edges of the head. +

coarse, and (6) extremely coarse. A series of photomicrographs have been prepared illustrating these arbitrarily chosen "standard" grain sizes which incidentally were remarkably consistent throughout all of the rivet samples. In other words, wherever "fine", "medium", or any other grain size is designated in different diagrams, the actual size did not vary among the different rivets. Fine grain in one rivet had the same physical dimensions as a fine grain in some other rivet.

✦ ✦ ✦

FIGURES 115 through 121 represent the various designated grain sizes ranging from very fine to extremely coarse. The magnification in each case was 150 diameters.

✦ ✦ ✦

The Mechanism of Grain Growth

GRAIN growth in low carbon steel can be accomplished in either of two ways, namely, by heating to temperatures far in excess of the critical range or, as mentioned previously, by annealing critically stressed steel to temperatures in the range of 1250 degress F. to 1550 degrees F.

✦ ✦ ✦

AS an illustration of the former type of grain growth, namely, by heating above the critical range, we cite the following example: A plain round, ¾" diameter, bar having the following analysis—carbon 0.04, phosphorus 0.012, sulphur 0.027, and manganese 0.30 percent—was forge welded into a chain link. A slight bending stress caused failure of the link by snapping off in a manner resembling the breakage of glass. The fractured surface showed the presence of extremely coarse grains resulting from the effects of the high welding temperatures. Figure 122 revealed the microstructure to consist of extremely coarse ferrite

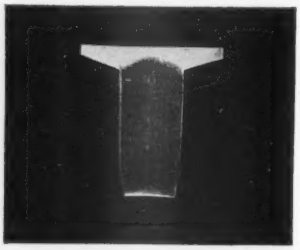


Fig. 114. A photograph of an etched unannealed rivet showing the highly strained areas in the head and point. ✦ ✦ ✦

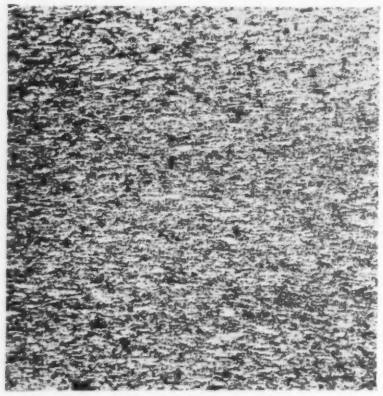


Fig. 115. Severely distorted grains in the head of a rivet direct from the machine. X-150. ✦

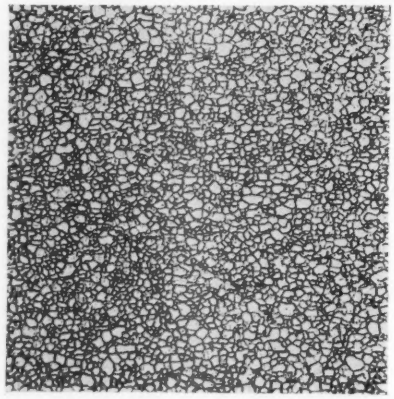


Fig. 116. Very fine grain in an annealed rivet, according to an arbitrarily chosen standard. X-150. ✦ ✦ ✦ ✦

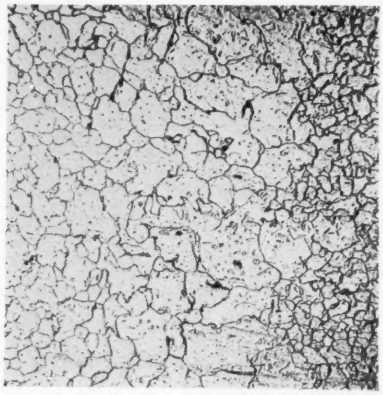


Fig. 117. Fine grain in an annealed rivet. X-150.

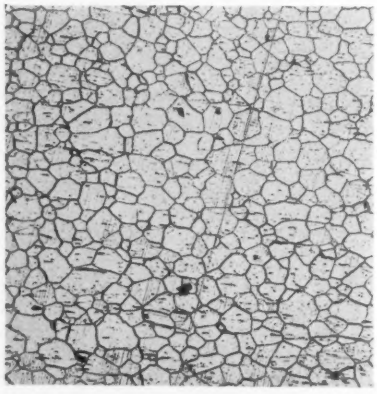


Fig. 118. Medium size grain in an annealed rivet. X-150. ✦ ✦ ✦ ✦

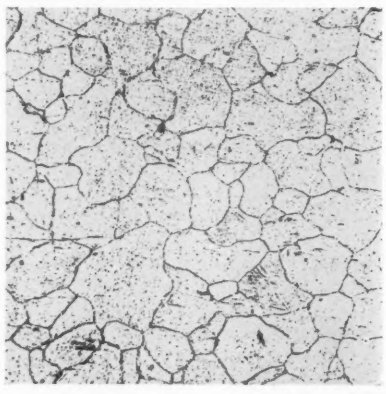


Fig. 119. Large grain in an annealed rivet. X-150.

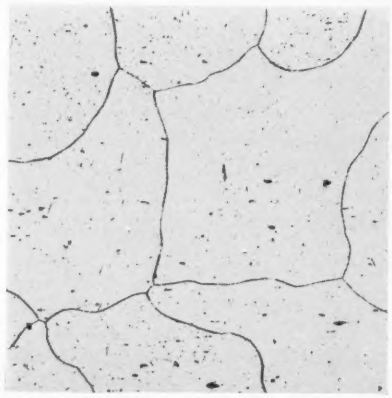


Fig. 120. Coarsen grain in an annealed rivet. X-150. ✦ ✦ ✦ ✦

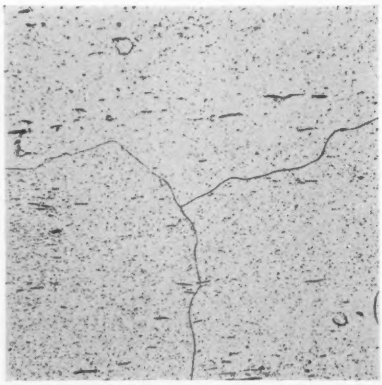


Fig. 121. Extremely coarse grain in an annealed rivet. X-150. ✦ ✦ ✦

grains in which condition the toughness and ductility usually associated with this type of steel was reduced to practically zero. Figure 123 shows a nearly full size cross sectional and longitudinal view of the fractured surface.

✦ ✦ ✦

IN this investigation we are not concerned with grain growth resulting from the effects of extremely high temperatures since our annealing temperatures range from 1200 degrees F. to 1750 degrees F. Instead we are confronted by the fact that rivets made from different kinds of wire in regard to their drafting and heated for varying lengths of time at different relatively low temperature levels exhibit a great variety of complex grain structures, ranging from very fine to extremely coarse grains—all in the same rivet.

✦ ✦ ✦

THE amount of cold work or cold deformation which will produce excessive grain growth, while dependent to a certain extent upon time and temperature, nevertheless, falls into a fairly narrow range and is herein referred to as critical strain. It is now generally known that for each degree of strain there is a critical temperature for grain growth.

✦ ✦ ✦

SINCE rivets are made from cold drawn wire, one may readily concede the fact that it is quite possible to have a number of different conditions regarding the existence of strain in the rivet as it comes from the upsetting machine. If the draft is heavy the strain has exceeded the critical value and is also more or less uniformly distributed in the wire so that subsequent annealing fails to produce excessive grain growth and we have the situation illustrated by rivet sample No. 1. On the other hand, where the draft is relatively light, according to **Lewis** (6) under 20 percent, the strain may be confined to a relatively narrow zone on the outer surfaces of the wire which when annealed at certain critical temperatures will produce grain growth. Such cases are

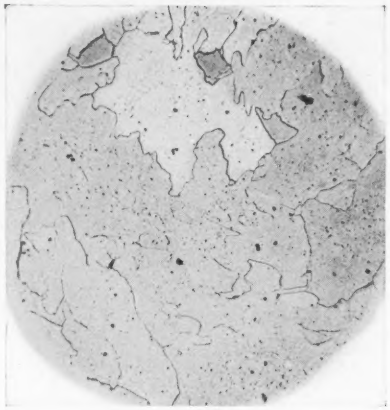


Fig. 122. Coarsened grain in a highly heated forge-welded chain link. X-125. ✦ ✦

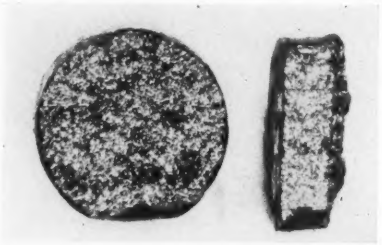


Fig. 123. Appearance of fractured surfaces of same material as shown in Fig. 122. Slightly enlarged. ✦ ✦ ✦

illustrated by rivet samples Nos. 2, 3 and 4.

✦ ✦ ✦

SAMPLES Nos. 2, 3 and 4 were process annealed preliminary to the final light draft for facilitating the pointing of the rivet. Samples Nos. 2 and 4 received the same amount of final draft yet their grain coarsening tendencies differ which indicates that other factors besides the amount of cold deformation have contributing effects.

✦ ✦ ✦

THE tendency toward coarsening of the skin is readily observed in sample No. 4 at temperatures as low as 1200 degrees F., whereas no skin coarsening effects are noted in sample No. 2 until a temperature of 1350 degrees F. is reached. This leads one to believe that perhaps the physical state of the original grains plays an important role in determining the amount and distribution of the strain resulting from the final draft.

✦ ✦ ✦

SAMPLE No. 3 showed coarsening tendencies at temperatures as low as 1200 degrees F. and exhibited the greatest coarsening tendencies of all of the rivets. At 1250 degrees F. and 1300 degrees F. the rivets had coarsened completely throughout the section at the end of 4 hours.

✦ ✦ ✦

IN practically all cases, the coarsening under the heads of the rivets resulted in smaller sized grains than in the shank and was confined to a relatively narrow zone. Figures 124 and 125 are typical examples of the coarsening which occurred under the heads of the rivets. The upper ⅓ of the photomicrograph shows the fine or very fine grain in the head, the middle ⅓ shows the coarsened zone while the lower ⅓ shows the fine grain in the shank. In some cases the coarsened zone showed much larger grains and in other instances the grain was smaller. The approximate size of these "under the head" coarsened zones are indicated on the rivet diagrams.

✦ ✦ ✦

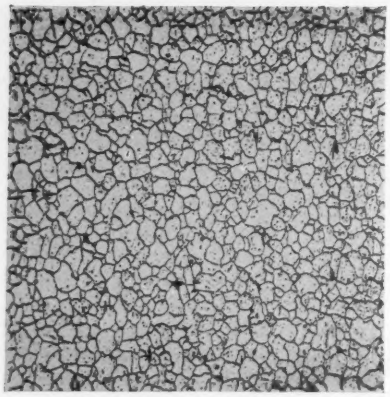
A VERY interesting comparison can be made of the resulting structures obtained with samples Nos. 1 and 3, annealed for 8 hours at 1450 degrees F. Here we observe exact opposites in structure, that is, where one is fine grained the other is extremely coarse and vice versa. Apparently the head on sample No. 1 was "overstrained" for all temperatures except the critical temperature of 1450 degrees F. The same tendency toward "head coarsening" was observed with sample No. 2 at the temperatures of 1450 degrees F. and 1550 degrees F.

✦ ✦ ✦

COMPLETE grain refinement occurred at 1650 degrees F. for samples Nos. 2, 3 and 4. Sample No. 1 which resisted grain growth except at 1450 degrees F. showed complete refinement at 1550 degrees F. Sample No. 3 showed a decided tendency toward refinement at 1550 degrees F. but which nevertheless exhibited coarsened zones although of greatly decreased magnitude.

✦ ✦ ✦

AN interesting fact concerning the coarsened zone observed in sample No. 3 at 1550 degrees F.

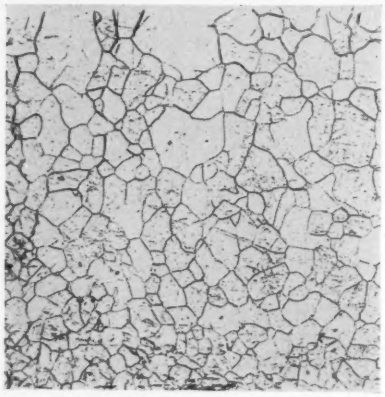


Fine grain in head of rivet.

Coarsened zone under the head.

Fine grain in the rivet shank.

Fig. 124. Typical example of coarsening under the head of a rivet. X-150.

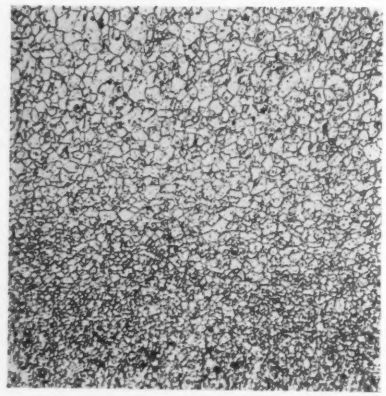


Large grains near outer edge of rivet.

Medium size grains.

Fine grains in interior of rivet.

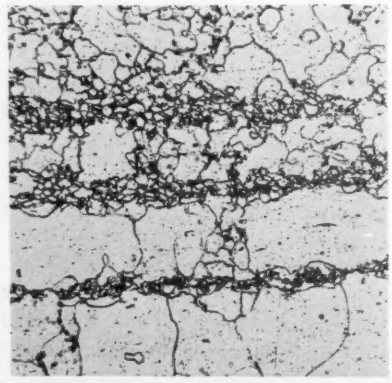
Fig. 126. The change in grain size from exterior to interior is gradual. X-150.



Fine grain interior of rivet.

Very fine grain in the extreme end of the point of the rivet.

Fig. 128. Gradual change in grain size from very fine in the extreme tip of the point of the rivet to the fine grain in the interior of the remainder of the shank. X-150.



Interior of rivet.

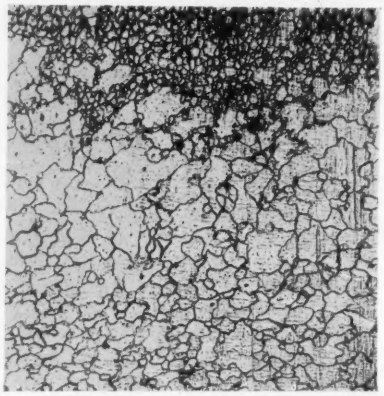
Band of very fine grain.

Band of very fine grain.

Band of very fine grain.

Coarsened exterior to edge of rivet.

Fig. 130. Opposite edge of rivet shown in Fig. 129. Observe three distinct bands of very fine grain. X-150.

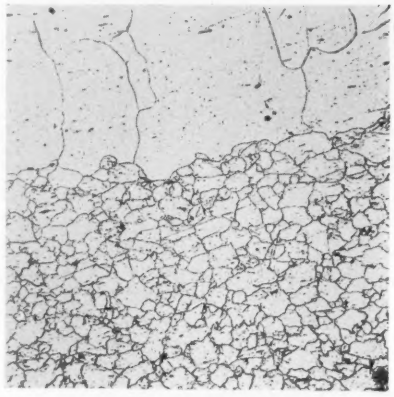


Very fine grain in head of rivet.

Coarsened zone under the head.

Fine grain in the rivet shank.

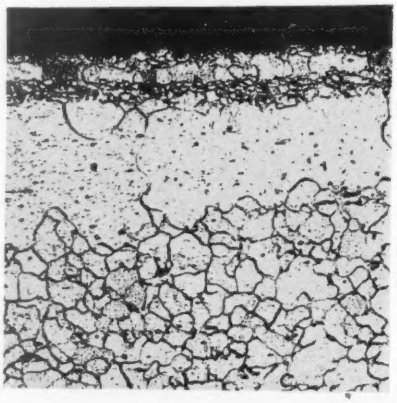
Fig. 125. Another example of coarsening under the heads of rivets. X-150.



Coarse grained exterior zone in the rivet shank.

Fine grain interior of rivet.

Fig. 127. A typical example of the abrupt change in grain size from the coarsened exterior or skin and the fine grain interior of the rivet. X-150.



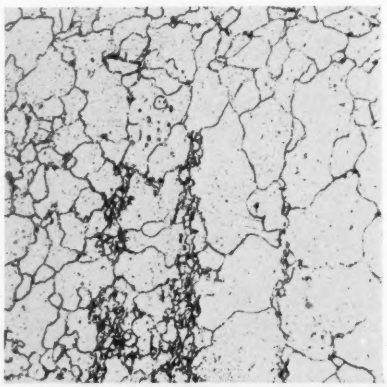
Edge of rivet.

Band of very fine grain.

Coarse grain.

Interior of rivet consisting of fine and medium size grains.

Fig. 129. A narrow band of very fine grain near the outer edge of the rivet over a coarsened zone occurred in a few instances. X-150.



Head of rivet.

Outer edge of rivet.

Fig. 131. The three bands of very fine grain shown in Fig. 130 are shown to disappear near the head of the rivet. X-150.

Fig. 131
Interior of rivet.

was the fact that the change in grain size from coarse to fine was gradual as shown in Figure 126. Excepting the coarsening observed in the tips or points of the rivets, this was the only case of gradual coarsening in the shank, all other grain size changes being abrupt as shown in Figure 127. Figure 128 shows a gradual grain size change from very fine to fine observed in the tips or points of the rivets.

✦ ✦ ✦

IN one or two instances a very narrow band of fine grain was observed on the outer skin with the coarse grains beneath the surface. Still more interesting from a purely metallographic viewpoint were the structures illustrated in the following photomicrographs. Observing the bands of structures from top to bottom, Figure 129 shows the extreme edge of the rivet on the top, then a narrow band of medium grains mixed with some very fine grains, next a narrow band of very fine grains, then follows a wide zone of coarse grain and next is shown the interior of the shank of the rivet which consists of a mixture of medium and fine grains.

✦ ✦ ✦

IN the same rivet but on the opposite side we observed the existence of three distinct bands of very fine grains. The "ends" of these bands were observed up to the junction of the head and shank at which point the bands faded out. These structures are illustrated in Figures 130 and 131 respectively.

✦ ✦ ✦

COLD deformation in this particular case, drawing and upsetting, result in an increase in hardness commonly referred to as strain hardening. The grain structure in the case of severe deformation is drastically altered as can be seen by observing the grain structure of an upset rivet head. Upon heating a temperature is finally reached at which point recrystallization takes place with the appearance of a completely new grain structure, a most common resulting structure being that shown in Figure 116.

THE lowest temperature at which this new equi-axed grain structure appears is called the recrystallization temperature at which temperature most of the strain hardening effects disappear. Time of heating, however, is an important factor in determining the recrystallization temperature. Time of heating is certainly an important factor in grain growth as can readily be observed by comparison of the rivet diagrams for the various lengths of time. Increase in time increases the amount and degree of coarseness. While the terms recrystallization and grain coarsening do not refer to quite the same phenomena, the laws governing recrystallization seem also to apply in general to the grain coarsening tendencies of critically strained metal.

✦ ✦ ✦

AS previously mentioned, grain size prior to the final drawing is an important factor in determining the degree of strain hardening, which in turn affects the recrystallization temperature. It is already known that smaller size grains show greater strain hardening effects for a given deformation, and hence have a lower recrystallization temperature. From data on hand, it would also appear that the grain coarsening tendencies are affected in a similar manner, that is, the grain coarsening temperatures are lower. This is illustrated by comparing the grain structures of rivet samples Nos. 2 and 4, both of which had the same amount of deformation in the final draft, namely 55 percent; but which showed considerable differences in their grain growth tendencies. Sample No. 4 originally having fine grains showed lower coarsening temperatures than sample No. 2 which had a considerably larger grain in the original, unannealed state.

✦ ✦ ✦

NOT only the coarsening temperature but also the amount of coarsening seem to be affected by the degree of strain hardening. This is illustrated by comparison of samples Nos. 3 and 4. Sample No. 3 had a reduction of 13.5 percent as against 5.5 percent for sample No. 4. The increased coarsening tendency for sample No. 3 is readily observed by comparison of the rivet diagrams. In this case the size of the original grains was the same, namely, a fine grain. It would appear, then, that for a given grain size the greater the amount of strain hardening, (within limits) the greater will be the coarsening tendencies.

✦ ✦ ✦

SINCE it is quite evident that a single individual rivet is in a very heterogeneous condition as regards the amount and location of strain, it follows therefore that the recrystallization temperatures vary within the rivet. It has also been shown that the coarsening tendencies vary making it possible to have complex grain structures ranging from very fine to extremely coarse in close proximity. If, however, the existing strain is in excess of the critical strain range, then coarsening will not occur under ordinary annealing conditions.

✦ ✦ ✦

THE effect of **McQuaid-Ehn** grain size on coarsening tendencies was not studied at this time since all of the samples had approximately the same inherent grain size characteristics not only in regard to the size of the grain, but also the degree of normality. Referring again to the **McQuaid-Ehn** grain structures illustrated in Figures 5, 6, 7 and 8, we observe the grain size to be of uniform size, approximately No. 4 according to the accepted standards for this test, and exhibiting a slight degree of abnormality. It seems reasonable to assume however that the inherent grain size might possibly have some slight effect on the resulting annealed grain structure due to the fact that steels possess in greater or lesser amounts, certain ingredients which determine the inherent grain characteristics. Such ingredients when present in abnormally large amounts, enough to be classed as harmful impurities, might possibly inhibit grain growth due to mechanical obstruction. This might possibly explain

the existence of the fine grain streaks in Figures 129, 130 and 131. We know that abnormal streaks are commonly observed in carburized steels when viewed along the main axis of rolling. The impurities, whatever they might be, are rolled out into elongated streaks within the body of the steel. It is believed, however, that certain smaller amounts of obstructive matter or impurities are a necessary adjunct to grain coarsening.

✦ ✦ ✦

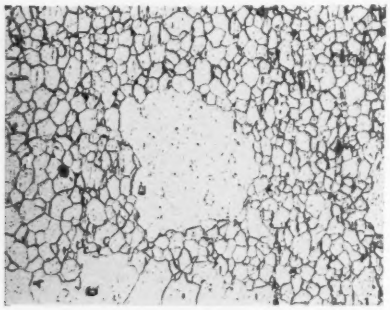


Fig. 133. Large grain surrounded by much smaller grains. X-150. ✦ ✦

THAT grain growth procedes by boundary migration seems to be evident from observation of the grain growth occurring under the heads of the rivets studied herein. While new boundaries were observed, remains of the old boundaries of the originally smaller grains were also noted. In some cases, small grains were observed within the larger grains. In the case of somewhat higher carbon steels, the pearlite which originally existed between the grain boundaries of the small grains, after coarsening are observed to exist within the body of the larger grains. Figure 132 illustrates such a case.

✦ ✦ ✦

GRAIN growth results from a condition of thermodynamic instability and tends toward a state of least energy. By growing in size the surface energy or surface tension for a given mass of material is lowered and a more stable condition exists. Grain growth therefore depends not only upon the size of the original grains but also upon the degree of grain contrast present. For this reason, under favorable conditions, the fine

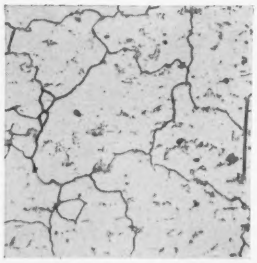


Fig. 132. Pearlite areas from an originally fine grained structure now existing within the boundaries of a recrystallized, coarsened ferrite grain. X-125. ✦ ✦ ✦ ✦

grain samples should show the greatest grain coarsening tendencies. This we observe to be the case by comparison of rivet samples Nos. 2, 3 and 4. Grain contrast apparently plays an important role in grain growth since in every case where a coarsened band occurs at some particular temperature for the 10 minute annealing time, the width of this coarsened band increases rapidly with increase in time. It is interesting to note that the same degree of contrast exists between the large and small grains for the various samples, only the width of the coarsened band varies. Figures 133 and 134 illustrate two cases of grain contrast found in the rivets studied in this investigation, one in which a large grain is surrounded by smaller grains and vice versa.

✦ ✦ ✦

Prevention of Excessive Grain Growth in Rivets

WE have seen that grain growth results from the combination of a critical amount of strain followed by annealing for a comparatively long period of time at temperatures ranging from 1250 degrees F. to 1550 degrees F. It would seem evident therefore, that in order to eliminate grain growth, annealing should be carried out at temperatures below 1250 degrees or above 1550 degrees F. From data at hand, we note that at temperatures of 1650 degrees F. and above, complete refinement of grain takes place. This occurs due to the fact that the steel has been heated above its upper critical temperature and has changed to austenite, so that in cooling from this homogeneous state, it is reborn, so to speak, without leaving any vestige of its former structure. This, then, offers one means of prevention.

✦ ✦ ✦

CONTINUING along the same line of thought, grain growth could be avoided by heating to temperatures below the coarsening range, say under 1250 degrees F. The amount of grain coarsening which takes place below 1250 degrees F. is negligible.

✦ ✦ ✦

ANOTHER convenient method of preventing grain growth

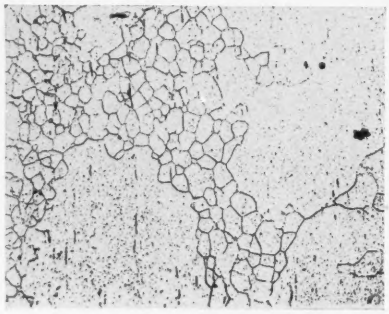


Fig. 134. Small grains surrounded by larger grains. Grain growth occurs by boundary migration. X-150. ✦ ✦ ✦

would be to increase the amount of reduction in the wire so that the resulting strain hardness would not be of a critical value and thereby be susceptible to growth. This method is exemplified by the tests performed on rivet sample No. 1 which had the greatest amount of cold deformation.

✦ ✦ END OF PART II ✦ ✦

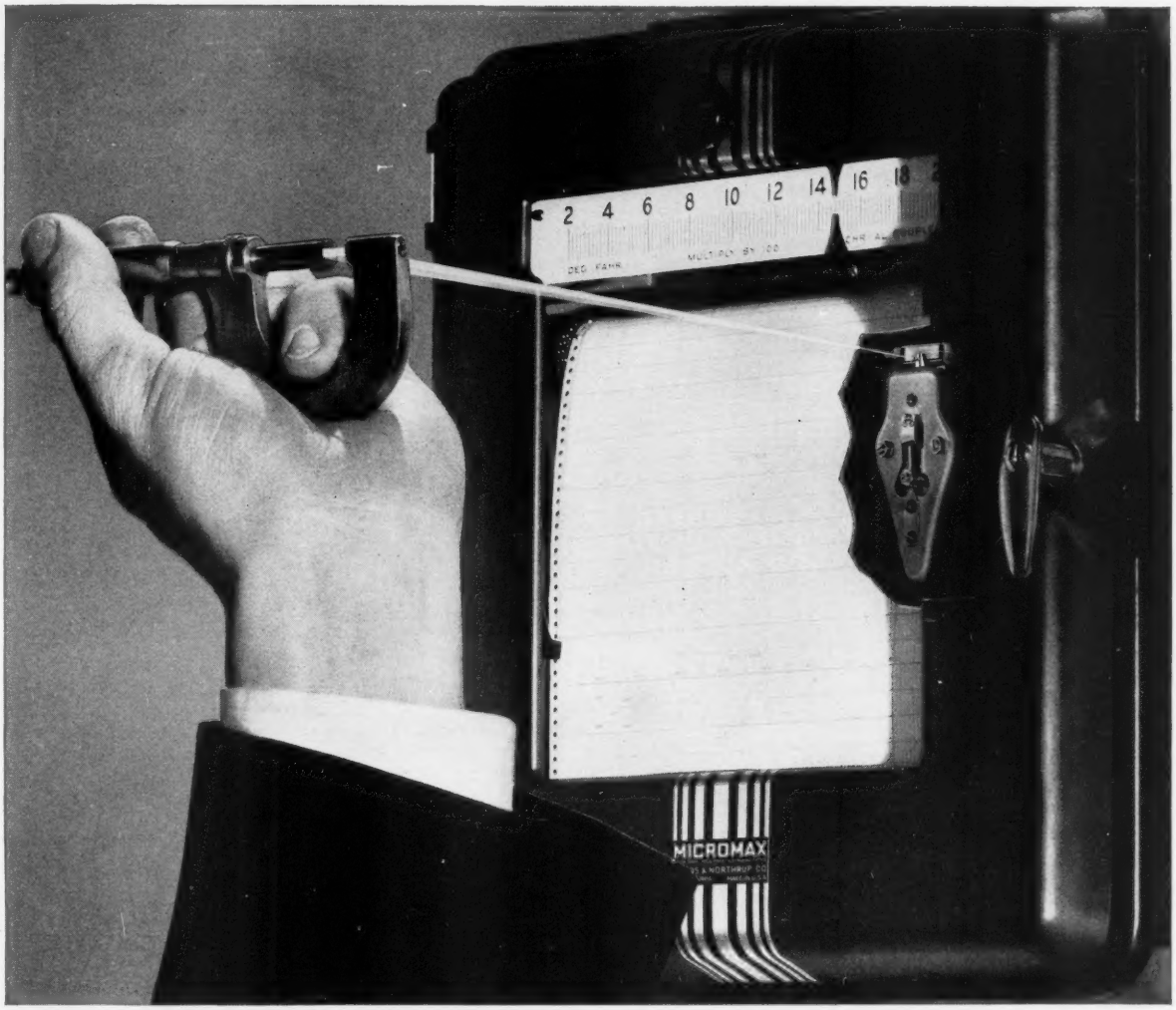
This paper to be published in three parts.

Part I (July) contained:

1. Examination to ascertain reason for abrupt changes in grain structures of rivets.
2. Factors affecting grain growth through annealing.
3. Prevention of excessive grain growth in rivets.

Part III (September) will contain:

1. Tensile test data.
2. Miscellaneous physical strength data.
3. Hardness data.
4. Summary.
5. Bibliography.



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J-N33(22)

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Vol. 13 AUGUST, 1938 No. 8

The Manufacture of Spring Wire From Low Carbon Steel

PART II

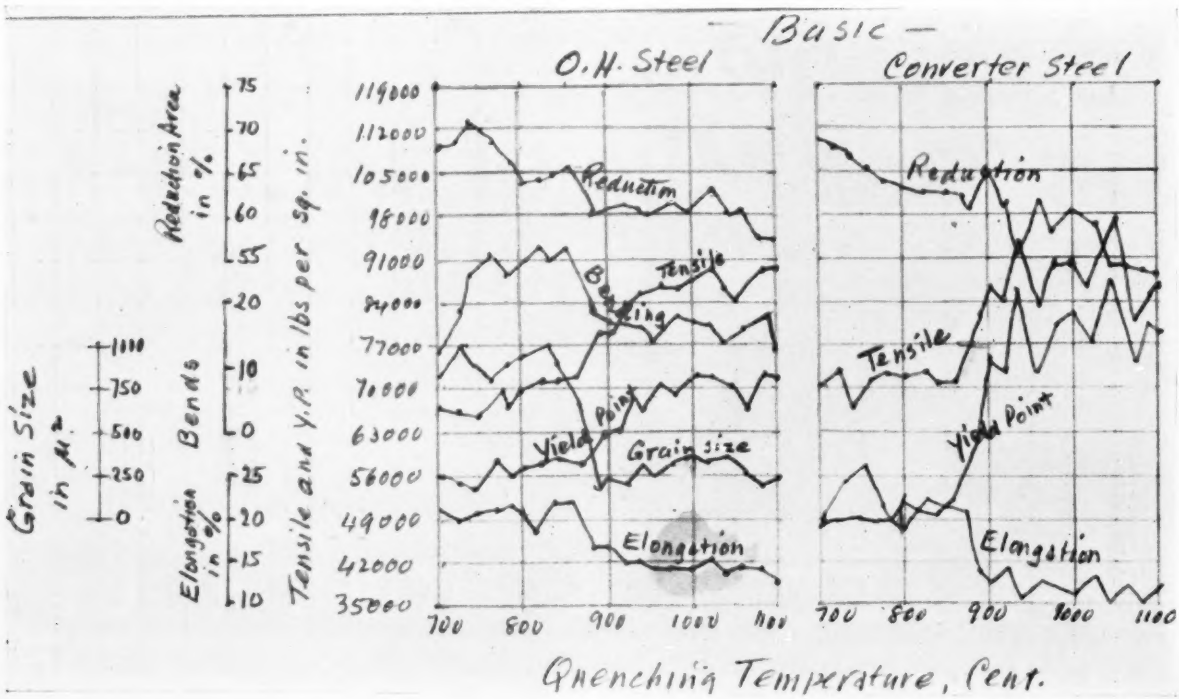
By Dr. Hans Wiescke,
Of Duisburg

A study of the hardening properties of low carbon steel (.10 carbon and below) and the adaptability of such steel for the manufacture of spring wire and wire products. Published in two parts. ✦ ✦ ✦ ✦

Influence of Quenching Temperature

IN figure 8 is recorded for a basic open-hearth steel of .075 carbon and .34 manganese and a basic converter steel of .065 and .54 respectively, the tensile values, bends, and grain size resulting from quenching at different temperatures. The transition point is especially strongly marked in the converter steel. The yield point jumps about 35,000 lbs. between

Fig. 8. Influence of quenching temperature on physical properties, number of bends, and grain size.



860° and 940° C. The falling of the tensile between 1020 and 1080° C. and the radical change in the other properties (less grain size) have been frequently noted and reported. The reasons are variously assigned as influence of the surrounding atmosphere at temperatures over 1000° due to increased mobility, expulsion of gases, decrease in tenacity of the films at the grain boundaries, chemical re-combination, and changing of grain size by an altered rate of germination and crystal accretion.

✦ ✦ ✦

THE weakness below 800° C. is explained by the researches of **G. Masing (25)** and **W. Köster (26).** The age-hardening of low carbon steel quenched below A_3, announced by them at that time as a newly discovered phenomenon, was already known to the trade, and advantage was being taken of it by holding quenched rods in storage to allow a further hardening. This product is no different in structure from the normal ferrite aggregate, so far as can be established. Here is an explanation, perhaps, of the simultaneous occurrence of a normal structure and an abnormally high tensile in some quenched steels. The fact that storage is resorted to, to get the desired tensile by aging, indicates that often the stock is not quenched above A_3, but picks up its tensile as a result of the "new transformation" discussed by Masing and Köster.

✦ ✦ ✦

Metallographic Condition

FROM 850° upward appears, in place of the previously noted polygonal ferrite crystals, an irregular quenched structure with an ever increasing amount of a needle-like constituent. Opinions

Fig. 9. Quenched low carbon rod. Transition ferrite-martensite.

✦ ✦ ✦

regarding this needle structure are diverse. (12, 13, 17, 20, 27). The most logical seems that of **Maurer (13)** that we are dealing here not with a new structure but with a normal structure which has suffered deformation. This is fairly well supported by researches on intermediate stages. Fig. 9, of quenched steel, shows transitions from bands and needles, which appear to bear out **Maurer's** contention. Both **Osmond (27)** and **Oberhoffer (17)** agree with him. The enlarged grain at the edge persisted through the recrystallization above the A_3 point, so that the grain size before and after hardening seems about equal.

✦ ✦ ✦

Water Temperature

THE influence of water temperature is shown in Fig. 10. A higher temperature reduces the cooling speed. The intensity of the hardening is very largely dependent on the speed of cooling. With low carbon such a quick cooling is necessary that it is practically impossible to hold the structure above the GOS line (19).

✦ ✦ ✦

DIFFERENCES noted between results in practical work and tensile values secured in laboratory furnaces with reheated and quenched specimens led to inquiries into the influence of the surrounding atmosphere and the coating of mill scale, and results on test pieces with mill scale, subjected to a half-hour annealing with access of air showed a drop in tensile of about 5500 lbs. per square inch. During the rolling process, and the swift passage of the rod there can be no effect from exposure to the air, nor from the scale. It is therefore clear why the rod quenched direct from its rolling temperature always shows a higher tensile. For the temperatures under consideration the difference can be figured at 4200 lbs. per square inch.

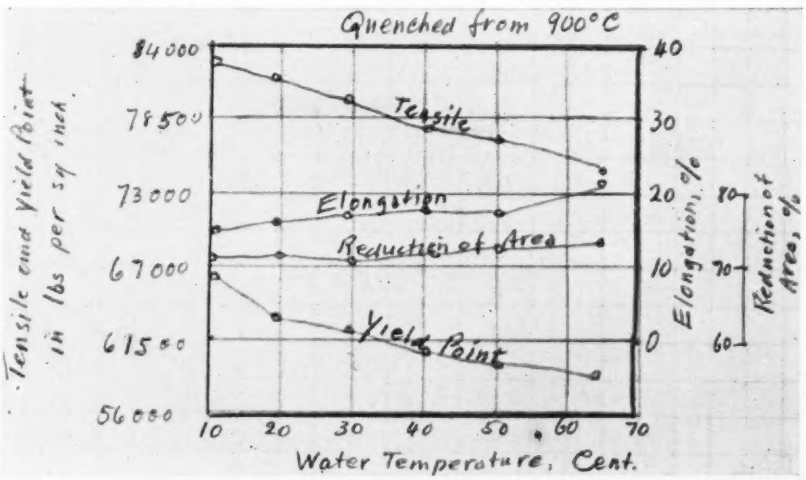
✦ ✦ ✦

Researches into Practice

IN carrying out the research into mill practice great care was taken to bring into play all influences tending toward uniform hardening, a high degree of elasticity and good Knotting ability, and to minimize all opposing influences, particularly those tending to retard the speed of cooling.

✦ ✦ ✦

Fig. 10. Influence of water temperature on quenching; on physical properties.



✦ ✦ ✦

SO far as rolling is concerned, the following are the fundamental desiderata:

1. A hot furnace.
2. Charging warm steel.
3. A high rolling temperature.
4. Close spacing between billets in the mill. (For steady increase in temperature of rolls, housings, and guides, and prevention of premature cooling of the rod.)
5. A short rolling and looping period.
6. A short run to the reels.

WITH regard to unit weight, these are the desired conditions:

1. Fewest possible number of entries, and therefore a small starting size of billet.

2. Small bundles, so as to reduce the run-off time and the reeling time.

✦ ✦ ✦

IN the quenching the following points deserve attention:

1. Quench as quickly as possible after the last pass.

2. Cool all parts of the bundle uniformly, and convey the heat from the section as rapidly as possible by an ample supply of running water.

3. Do not remove the bundle too quickly from the water, for fear of either incomplete quenching or self annealing.

✦ ✦ ✦

IN the mill experiments the quenching arrangement used was that shown in Fig. 5d, with a water bosh serving two reels. A trial (made after a shut-down of the mill) showed:

1. That no warming of the water should be allowed, as a small difference in temperature suffices to cut down the resulting tensile strength considerably.

2. That cold rolls, housings, and guides reduce the rod temperature considerably and spoil the effect of the quench.

3. That fluctuations in tensile within the bundle, at the usual figure of about 80,000, seldom exceed 4000 lbs. per square inch, so that a practically constant quench can be attained.

✦ ✦ ✦

THE principal research was conducted with a basic open-hearth steel of .06 C., .34 Mn., .039 P. and .048 S. Fig. 11 shows a remarkable steadiness in physical properties throughout the test, after the early fluctuations due to the cold start had steadied down. The tensile, at the close of the run, was still mounting slightly, the last few values averaging 98,000.

✦ ✦ ✦

THE difference in tensile strength may be attributable to the steel, and due to its segregation. Moreover there is a possibility that in spite of the extreme turbulence of the water supplied, the bundle could not harden uniformly because the steel was blanketed by films of steam. The length of the rod might also play a part, as its last end was of

Fig. 11. Record of the mill test. Tensile and Elongation and Difference of Tensile.

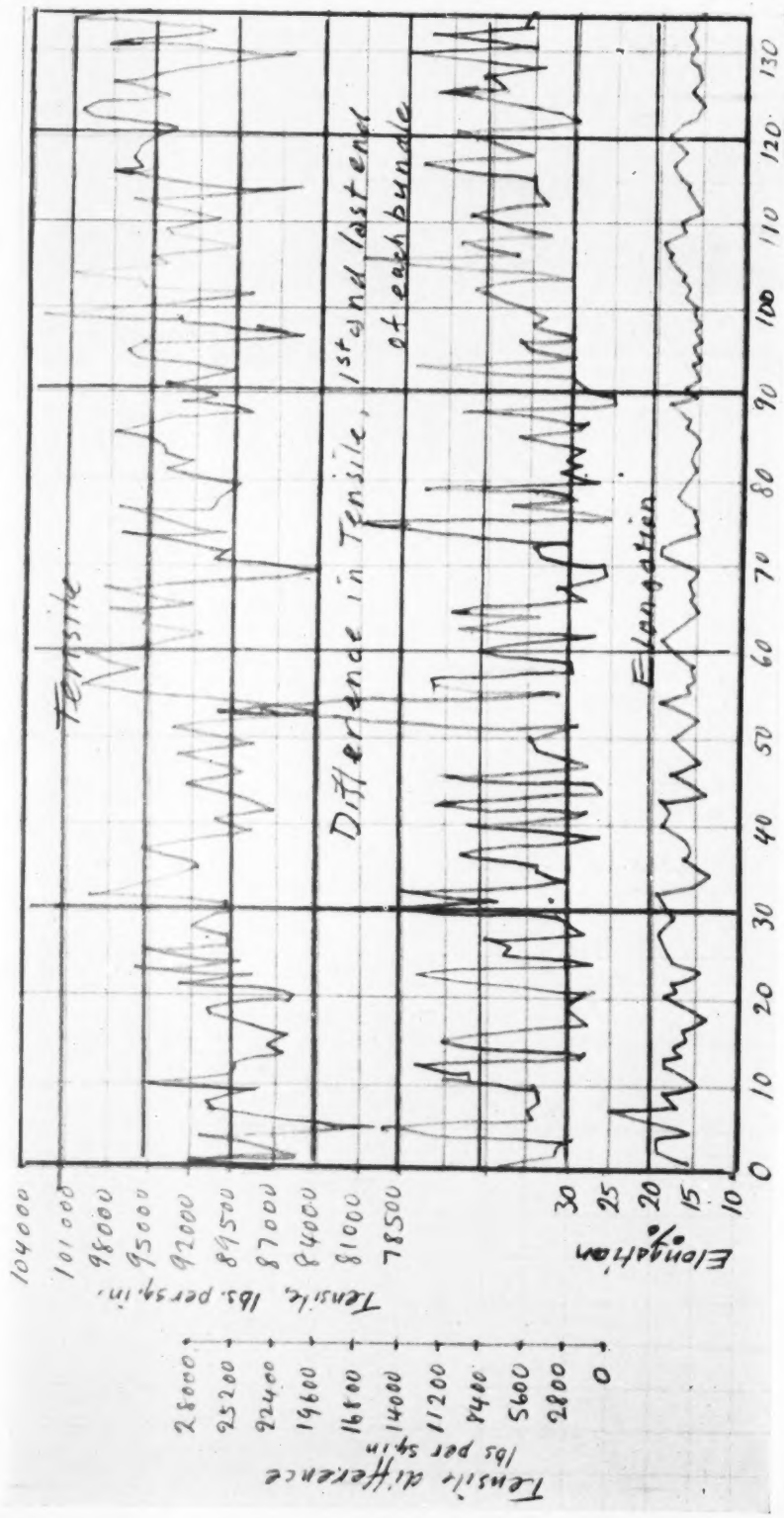

Tensile
Difference in Tensile, 1st end last end of each bundle
Elongation
Tensile, lbs. per sq. in.
Elongation %
Tensile difference lbs per sq in

Fig. 12. Frequency of Tensile values and Tensile differences in the principal test.

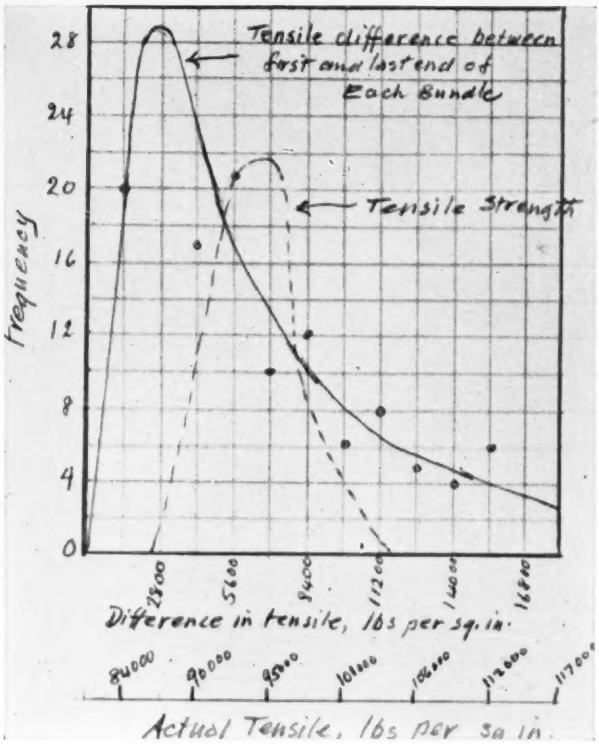
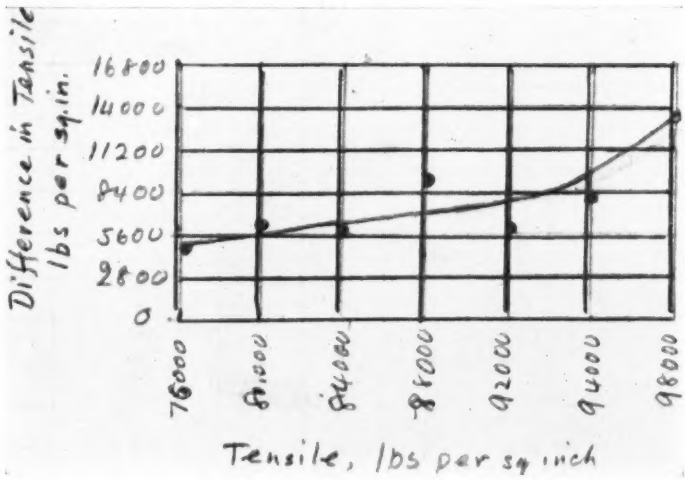


Fig. 13. Relation between actual tensile and tensile fluctuations between first and last end of each bundle.



Relation between tensile variation, first and last ends, and total tensile strength.

course on the looping floor a considerable time. However, the fact that this temperature differential was of comparatively little weight is shown by a comparison of the tensile at the first and last end of each bundle, in which the high value was found to be about as often at the last as at the first end. The mean tensile in this trial ran about 92,000 lbs. per square inch, and the maximum ran to 105,000. This tensile is excellent for making spring wire.

IN the matter of frequency of tensile differences between first and last ends of each bundle it is surprising to find the frequency curve broadening out so much after passing the peak (Fig. 12). The increase in fluctuations in the higher tensiles is shown in Fig. 13. In the interest of greater uniformity many plants aim for the lower tensiles.

✦ ✦ ✦

THE fine structure (Fig. 14a) (see Part 1) shows that the quenching was done barely above A_3. A high sulphur basic steel (open-hearth) with .08 C., .35 Mn., and .027 S., quenched at the same time, gave 94,000 lbs., a high phosphorus basic converter steel with .06 C., .43 Mn., and 078 P., gave 91,000.

✦ ✦ ✦

IT may be assumed that the steel used in the principal tests was satisfactory in further working, although some complaint might have been made on the grounds of softness.

✦ ✦ ✦

Further Working

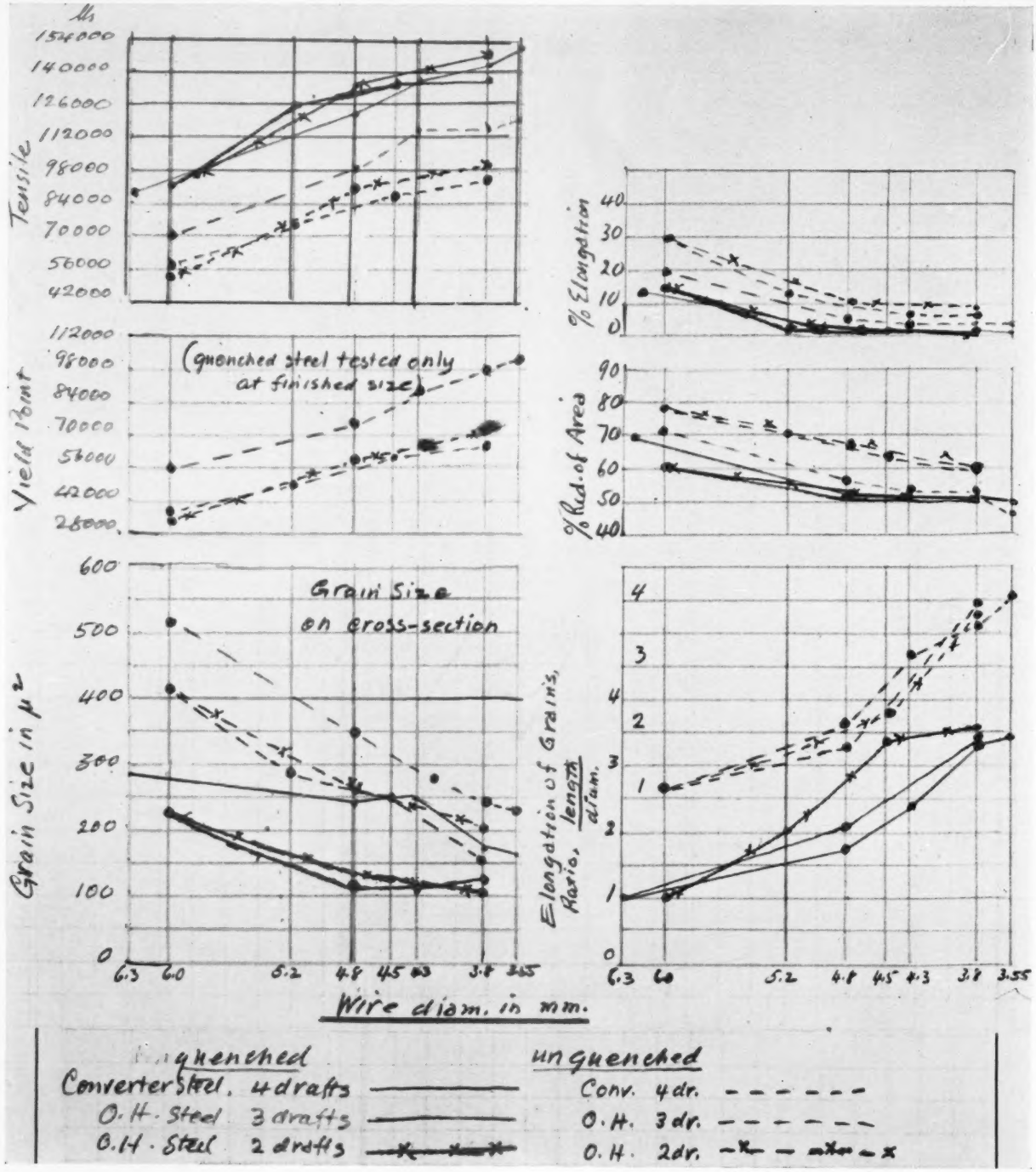
THE water-hardened rod is at last drawn into wire. The number of drafts naturally varies with the desired size, ranging from 2 to 4. Either 2 or 3 of these drafts are done after coppering. The average practice is to draw from a rod between 5.3 and 6.5 mm. and give it three drafts. This practice results in an increase in tensile of 42,000 to 56,000 lbs. per square inch, with the result that the wire, on the average, rises in tensile from 85,000 to 95,000 in the rod to 135,000 to 155,000 in the finished condition. Investigation shows that tensile differences within the bundles after cold work, are relatively small.

✦ ✦ ✦

Effect of Cold Work

IN order to determine the effect of cold work on the physical properties and structure of quenched compared with normal steel, two samples were carried through together, and submitted to exactly the same cold processing. The re-

Fig. 15. Influence of amount of cold work on physical properties and grain size.



sults are shown in Fig. 15. Fig. 16 shows the structure of 3.8 mm. finished spring wire.

✦ ✦ ✦

Summary

FOR practically uniform hardening a low carbon steel is desirable. Manganese has a good influence, and can be carried higher as the carbon drops lower. The rather lower tensile resulting from the use of very low carbon steel is balanced by a greater uniformity, and can be further compensated for by adjusting the amount of cold work. A greater stiffness can be secured by raising the carbon to .12, in which case the manganese can be reduced.

IT has been established that differences in the temperature (above A_3) from which the steel is quenched are overshadowed in importance by the suddenness of the quench.

✦ ✦ ✦

PHYSICAL properties are affected by cold working in quenched steels exactly as in normal steels.

(Please turn to Page 420)

TENTATIVE PROGRAM

FOR WIRE ASSOCIATION CONVENTION AT DETROIT, MICH., OCT. 17-21, 1938

WIRE ASSOCIATION HEADQUARTERS—REGISTRATION AND ALL TECHNICAL SESSIONS AT THE DETROIT-LELAND HOTEL

✦ ✦ ✦

MONDAY, OCTOBER 17, 1938

A. M.—Registration—"Get Together"

1 P. M. Directors' Meeting—Program Committee Meeting and Lunch

✦ ✦ ✦

PAPERS	AUTHORS	COMPANY
NON-FERROUS DIVISION		
"The Effect of Various Degrees of Cold Working and of Various Impurities on the Annealing Temperatures of Copper Wire"	L. B. Barker, Testing Engineer	General Electric Co. Schenectady, N. Y.
"The Development of Cadmium and Cadmium Tin Copper Trolley Wires; of High Strength Messenger Wires; High Strength Transmission Cables; Composite Cables; Hollow Conductors; etc."	C. H. Davis Metallurgist	American Brass Co., Waterbury, Conn.
Motion Picture: Manufacture of Oil-Filled Cable.		General Electric Co., Schenectady, N. Y.
STEEL DIVISION		
"Resilience of Spring Materials"	R. R. Tatnal, Engineer	Wickwire-Spencer Steel Co. Worcester, Mass.

TUESDAY, OCTOBER 18, 1938

NON-FERROUS DIVISION		
"Heating Furnaces and the Heating of Wirebars"	J. A. Doyle, Engineer	W. S. Rockwell Co. New York City
"Production of Aluminum Coated Steel and Other Coated Metals from a Hydrogen Furnace"	Prof. Colin G. Fink Electro-Chemist	Columbia University, New York City
"Experiments with Back Pull in Drawing Copper Wire"	L. Simons Mechanical Engineer	Master Wire Die Corp., New York City
STEEL DIVISION		
Lecture: "Principles of Metallurgy"	B. L. McCarthy, Metallurgist	Wickwire-Spencer Steel Co., Buffalo, N. Y.
"Wire Screens—Uses and Grades"	R. B. Roth, Purch. Agent	Ludlow-Saylor Wire Co., St. Louis, Mo.
	✦ ✦ ✦	
"Effect of Under Critical Annealing Treatments on Cold Drawn Steels"	F. C. Brandon, Metallurgist	Union Drawn Steel Div., Rep. Steel Corp., Massillon, Ohio
"Cold Heading"	H. L. Hopkins, Metallurgist	National Screw & Mfg. Co., Cleveland, Ohio

WEDNESDAY, OCT. 19th

STEEL DIVISION

Lecture: "Thermal Reactions"	B. L. McCarthy, Metallurgist	Wickwire-Spencer Steel Co., Buffalo, N. Y.
Wire Association Annual Meeting		
	✦ ✦ ✦	
Acid Disposal Symposium	L. F. Marek, Chem. Eng.	Arthur D. Little, Inc. Cambridge, Mass.
	S. F. Spangler, Chem. Eng.	Chemical Construction Corp. New York City
	Dr. Otto Mantius, Consult. Eng.	National Lead Co., (Acid Recovery Dept.) New York City

THURSDAY, OCT. 20th

STEEL DIVISION

Lecture: "Metallurgy of Steel Wire"	B. L. McCarthy, Metallurgist	Wickwire-Spencer Steel Co., Buffalo, N. Y.
"Stainless Steel Wire"	J. K. Findley Metallurgist	Ludlum Steel Co., Dunkirk, N. Y.
	✦ ✦ ✦	
"Rope Wire"	W. R. Bloxdorf, Metallurgist	MacWhyte Co., Kenosha, Wis.
"Wire Rope"	H. K. Hammerstein, Chief Eng.	Broderick & Bascom Rope Co., St. Louis, Mo.

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Exports and Imports of Wire

Exports of Iron and Steel Wire Products in May, 1938 and May 1937
(In gross tons)

	MAY 1938	APRIL 1938	MAY 1937
Wire rods	2,098	2,829	5,872
Strip steel	4,107	3,400	8,077
Plain, black or galvanized iron or steel wire	3,760	4,045	5,675
Barbed wire and woven wire fencing	2,617	2,583	4,086
Woven wire screen cloth	220	99	164
Wire rope	362	359	416
Insulated iron or steel wire and cable—see analysis below			
Other wire and manufactures	494	414	868
Wire nails	1,788	1,354	1,980
Tacks	17	21	22
Other nails, including staples	445	390	256
Bolts, machine screws, nuts, rivets and washers	739	671	1,321
Total, these 11 classifications	16,647	16,165	28,737

Imports of Iron and Steel Wire Into the United States
(In gross tons)

Concrete reinforcement bars	152	38	771
Hollow bar and drill steel	24	76	273
Wire rods	461	271	1,293
Barbed wire	727	554	962
Round iron and steel wire	134	98	484
Telephone and telegraph wire	.....	.....	.....
Flat wire and strip steel	161	188	366
Wire rope and strand	150	185	306
Other wire	124	86	428
Hoops and bands	2,140	1,579	2,393
Nails, tacks and staples	568	561	1,159
Bolts, nuts and rivets	9	17	16
Total, these 12 classifications	4,650	3,653	8,451

Exports of Insulated Wire and Cable, May, 1938

	Foreign		To U. S. Possessions	
	Pounds	Dollars	Pounds	Dollars
Rubber covered wire	399,932	$ 94,845	91,479	$16,587
Weatherproof wire	237,160	44,329	50,362	8,386
Other insulated copper wire	803,089	143,510	317,394	47,572
Nickel-chrome electric resistance wire	60,300	62,488	6	26
Total, these 4 classifications	1,500,481	$345,172	459,241	$72,571

EXPORTS of iron and steel wood screws during May, 1938 totaled 18,000 gross valued at $2,735. Of this total Mexico took 7,037 gross valued at $916; Cuba 3,777 gross valued at $456; Brazil 1,829 gross valued at $309; Venezuela 1,483 gross valued at $314; United Kingdom 1,370 gross valued at $181.

✦ ✦ ✦

EXPORTS of brass wood screws during the same month totaled 7,109 gross valued at $2,673. Of this total Brazil took 2,158 gross valued at $552; Cuba 2,066 gross valued at $546; Canada 1,234 gross valued at $547; Venezuela 480 gross valued at $337; Colombia 329 gross valued at $196.

✦ ✦ ✦

IMPORTS of wood screws during the same month totaled 10,950 gross valued at $742. Of this total Belgium supplied 6,350 gross valued at $506 and Japan 4,600 gross valued at $236.

✦ ✦ ✦

WITH European purchases continuing to taper off, exports of iron and steel products (excluding scrap) from the United States in May again recorded a decline. May shipments amounted to 166,319 gross tons valued at $10,899,772 in comparison with 179,250 tons valued at $12,061,586 in the preceding month. These totals compared with an export trade of 331,103 tons valued at $19,186,363 recorded in May, 1937, and which up to that time was in all probability at least the highest American postwar monthly trade in iron and steel materials. (Note: These totals were subsequently exceeded in July and August 1937).

Japan Remains Chief Market

IN May Japan continued to rank as the outstanding market and accounted for 49,747 tons against 53,723 tons in April, and 113,482 tons in May, 1937. The bulk of this trade was made up of pig iron (31,944 tons), ingots (12,902 tons), steel bars (3,053 tons), wire rods (1,625 tons), and car wheels (1,421 tons). Canada again ranked second with 19,488 tons against 11,857 tons and 40,717 tons with the most prominent items in this trade shapes (3,899 tons), black steel sheets (3,324 tons), strip steel (2,220 tons), ingots (1,849 tons), plate (1,192 tons), and steel bars (1,132 tons). Shipments to Kwantung continued high, a total of 19,488 tons going to that market against 11,857 tons and 815 tons. The most prominent items in this trade were plate (9,703 tons), shapes (5,642 tons), and steel bars (4,018 tons).

✦ ✦ ✦

SHIPMENTS to Venezuela totaled 7,277 tons against 3,841 tons and 4,568 tons—the principal item being casing and oil-line pipe (2,450 tons), followed by boiler tubes (1,448 tons), and shapes (573 tons). Next came the Soviet Union with 6,150 tons against 4,837 tons and 6,790 tons with black steel sheets (3,672 tons), strip steel (1,057 tons), boiler tubes (866 tons), and steel bars (701 tons), outstanding. The Philippine Islands ranked sixth with 6,130 tons against 5,884 tons and 8,442 tons, and the chief items were galvanized sheets (1,881 tons), steel bars (919 tons), tin plate (768 tons), wire nails (498 tons), and shapes (338 tons).

✦ ✦ ✦

Imports

FOLLOWING an upturn in April, the volume of semifinished and finished iron and steel imports into the United States during May resumed the downward movement evident since January. Aggregate receipts in May totaled 20.419 gross tons valued at $1.160,068 in comparison with 21,225 tons valued at $1,140,875 in April. The higher value in the current month was

(*Please turn to Page 414*)

Exports and Imports of Wire

(*Continued from Page 413*)

caused by an increase in steel pipe and structural shape imports. Against the 39,877-ton trade valued at $2,271,192 in May, 1937, the trade of May of this year is noteworthy, it was stated.

✦ ✦ ✦

FOR some months, pig iron imports have been recording a steady decline largely because of the unprecedented European and Japanese demand. In March, this trade dropped to its lowest volume in many years when only 746 tons were received. It moved up to 3,823 tons in April, but in May the trade again started downward when only 1,795 tons were imported.

✦ ✦ ✦

IMPORTS of structural shapes in May were the most important item in the month's trade from the standpoint of tonnage when 6,533 tons were received in comparison with 4,473 tons in April and 8,962 tons in May, 1937. The outstanding sources were Belgium 3,958 tons, and France 2,499 tons. Following came steel bars with 2,748 tons against 1,500 tons and 4,309 tons, and again Belgium was the leading supplier with 1,504 tons, followed by France 756 tons and Sweden 325 tons. Ranking third was hoops and bands with 2,145 tons against 1,579 tons and 2,393 tons and of the total Belgium accounted for 1,493 tons, and France for 539 tons. Steel pipe receipts amounted to 1,898 tons against 360 tons and 5,019 tons and here Germany accounted for 1,261 tons and Belgium for 373 tons. Pig iron ranked fifth in a trade totaling 1,795 tons against 3,823 tons and 6,361 tons and came principally from the Netherlands 1,004 tons and British India 498 tons.

✦ ✦ ✦

BELGIUM in May supplied 8,439 tons of iron and steel products to the United States in comparison with 6,624 tons in the preceding month and 15,511 tons in the like month of 1937. The outstanding products in this trade were shapes 3,958 tons; steel bars 1,504 tons; and hoops and bands 1,493 tons. France ranked next with 4,263 tons against 2,273 tons and 2,548 tons and here the leading items were shapes 2,499 tons; steel bars 756 tons; and hoops and bands 539 tons. Germany followed with a 2,880-ton trade against 3,003 tons and 7,148 tons, and the chief products were steel pipe 1,261 tons; and barbed wire 381 tons. The Netherlands accounted for 1,170 tons against 688 tons and 1,642 tons and pig iron (1,004 tons) was the main item.

✦ ✦ ✦

CARD CLOTHING receipts amounted to 5,630 square feet valued at $9,500 in comparison with 7,970 square feet valued at $14,397 in April, and came from the United Kingdom 4,546 square feet valued at $7,678; Belgium 889 square feet valued at $1,335; and Germany 195 square feet valued at $487.

✦ ✦ ✦

WIRE HEDDLE imports totaled 806,000 pieces against 1,054,000 pieces, and this trade was

(*Please turn to Page 423*)

MICROMETER PRECISION — MICRO-WELD — ELECTRIC WELDING

A complete portable unit machine for general purpose Butt Welding, instantly adjustable for various sizes of wire and perfectly adaptable for all wire manufacturing and fabricating requirements.

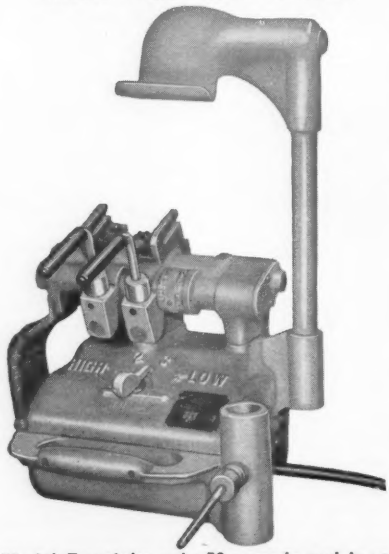
✦ ✦ ✦

THIS Welder is provided with a specially designed, sensitive limit switch, operating automatically with consistently uniform results on even the smallest sizes of wire, where reduced upset spring pressure is necessary. Tungsten contact tips are used in this switch to eliminate the maintenance and adjustment ordinarily required on copper contacts, which are customarily used for this service. By using the best material available in this equipment, positive, accurate results are secured under all conditions.

✦ ✦ ✦

Your inquiries are solicited.

MODEL "E"
MICRO-WELD BUTT WELDER



Model E weighs only 50 pounds and is so simply designed that anyone can weld wires from No. 4 to No. 20 gauge with it—instantly changing from one gauge to another.

EVERY working part of the machine is enclosed and protected from dirt and corrosion from acid fumes. The only servicing that is necessary, is an occasional brushing of the dies with the wire brush which comes with the machine, and an occasional oiling with Three-In-One oil in the four oil holes which are visible on the index barrel and slides.

✦ ✦ ✦

HIGH electrical efficiency, with only 2½ KW rating at full capacity, allows light socket operation, which further increases the general utility of this adaptable Welder.

✦ ✦ ✦

FOR especially rugged service or for traveling crane mounting, this machine is also available made from high strength bronze, at no additional increase in price.

✦ ✦ ✦

Your inquiries are solicited.

MICRO PRODUCTS COMPANY — MICRO-WELD — 20 N. WACKER DRIVE • CHICAGO

'Round the World With the Wire Industry

ISCOR Produces Millionth Ton of Steel

THE **South African** Iron and Steel Corporation at Pretoria produced its millionth ton of steel. It took 2½ years to manufacture the first 500,000 tons, but only 1½ years for the next 500,000 tons. Today it employs 2,250 Europeans. It pays a monthly wage bill of £60,000 (about $300,000), and in the four years of its existence it has paid out in wages about £25,000,000. About 99 percent of the raw material used in the production of its steel is of South Africa origin. Some of the iron ore comes from the Pretoria district, but the bulk comes from the company's own mines at Thabazimbi, where it is estimated that there is sufficient reserve to last 100 years. The company has at least reached its maximum output under present conditions, but only meets a portion of the South African market, as it is necessary to import still a considerable quantity of steel annually.

✦ ✦ ✦

Stainless Steel for Nickel In Germany

CONSIDERABLE economy is being exercised by **Germany** in the consumption of nickel, shortage of which having turned the attention of manufacturers to chromium steel, chromium molybdenum steel, and chromium manganese steel, advises the American Consulate in Cologne. In order to conserve high grade metals, processes are said to have been developed which permit the combination of a certain layer of stainless steel with iron in such a way that a uniform material is the final product. This report, while brief, contains information covering the type of stainless steel manufactured in Germany because of the present shortage of nickel, and is available for loan to qualified American subscribers.

✦ ✦ ✦

Turkish Iron and Steel Plant At Karabuk

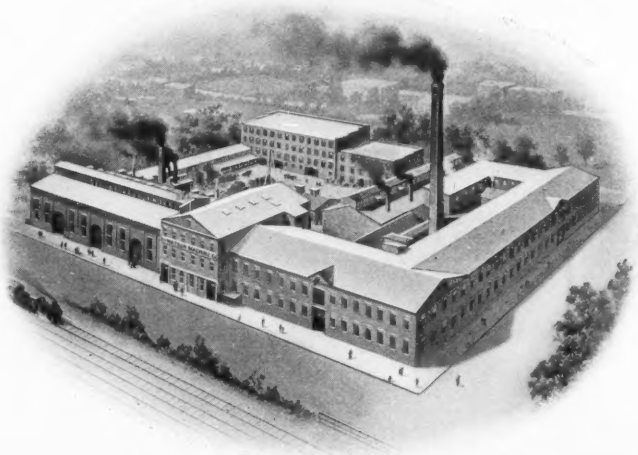
THE construction of an iron and steel plant at Karabuk, near Zafranbol, **Turkey**, was started in April 1937, it is pointed out in a report from the American Embassy at Ankara. When completed, the plant will cost in the neighborhood of 18,000,000 Turkish pounds, and represents the largest individual investment made by Turkey in the industrial field. The construction of this plant is in the hands of H. A. Brassert & Company, Ltd., of London, and the construction work will be financed for a period of 8 years. Payment will be made to the Anglo-Turkish Comptoir in London by marketing ores and min-

(*Please turn to Page 416*)

THE WATSON MACHINE COMPANY

ESTABLISHED 1845

PATERSON, NEW JERSEY, U. S. A.



ENGINEERS MACHINISTS

MANUFACTURERS OF

ELECTRICAL WIRE & CABLE, WIRE ROPE, CORDAGE & GENERAL MACHINERY

YOUR INQUIRIES ARE INVITED

'Round the World With The Wire Industry

(*Continued from Page 415*)

erals in the United Kingdom and in the British Empire. The works are of considerable magnitude and consist of a coke oven, two blast furnaces, steel works, a rolling mill, a repair workshop, a pipe factory and smelting works, and a power house of 15,000 kilowatts. The daily consumption of raw materials will include 1,200 tons of iron ore, 220 tons of limestone and 1.300 tons of coal. Some 600 tons of steel ingots will be produced daily. The by-products of the coke oven will be benzol, ammonia and tar, it is stated. It is estimated that the annual output of pipes and tubes will reach some 20,000 metric tons. It is expected also that the output of the Karabuk plant will cover a large proportion of the requirements of the Turkish market. The principal imports of steel and allied products for the year ended December 31, 1937, consisted of "iron and steel products", 59,759 tons, rails (for railroads) 16,368, iron and steel sheets 16,136, iron and steel plates, etc. 15,077, and "heavy iron products" 9,786. The total value of imports of iron and steel items of all classes during 1937 was 18,292,000 Turkish pounds. Germany was the leading supplier in the first 10 months of that year.

✦ ✦ ✦

N. Davidson, Technical Director Sir James Farmer Norton, Ltd., Adelphi Works

WE are pleased to announce that Mr. N. Davidson has been appointed technical director of Sir James Farmer Norton & Company Limited, Adelphi Iron Works, Salford, 3, Lancashire, Manchester, England.

✦ ✦ ✦

German Notes

AS the wire industry reports from abroad, supplies of wire rods to the German industry are more satisfactory. The normal production quantities are fixed, although there is still a shortage in case the manufacturers want to produce beyond their allotments. German production of wire rods during the first 5 months of 1938 was about 62,000 tons higher than same time last year, an increase of 14%, whereas export sales of wire rods were comparatively small. The official prices have been well maintained. A few markets only, such as Holland and certain Latin American markets will have lower prices. Very large quantities are absorbed by the domestic German market, particularly on wire nails.

✦ ✦ ✦

THE wood screw export business is most patchy. Markets buy less than they did one year ago, whereas prices are still maintained. On the other side the domestic business is well maintained. There are no stocks existing and backlogs are very heavy.

✦ ✦ ✦

A SATISFACTORY improvement is to be noted as regards the demand for wire products from China. Orders from Shanghai have considerably revived, though Shanghai's purchases of this year

(*Please turn to Page 421*)

THE MACHINES THAT PUT THE "RINGS" IN SPRINGS

DESIGNERS AND MANUFACTURERS
OF EQUIPMENT FOR
THE WIRE MILLS AND SPRING MAKERS

UNIVERSAL SPRING COILERS
TORSION SPRING MACHINES
FLEXIBLE CASING AND
FLEXIBLE METALLIC TUBE COILERS
STRAIGHTENING AND BUNDLING MACHINES
RING COILING MACHINES FOR BRAZING
KEY RINGING MACHINES
COLD ROLLING EQUIPMENT FOR WIRE
SPECIAL MACHINERY OF ALL TYPES

YOUR INQUIRIES INVITED

SLEEPER & HARTLEY, Inc.
WORCESTER — MASSACHUSETTS

A Review of Recent Wire Patents

No. 2,119,513, HELICAL SPRING MACHINE, Patented June 7, 1938 by Carl H. Peterson, Worcester, Mass., assignor to The American Steel and Wire Company of New Jersey, a corporation of New Jersey.

The device may be applied to spring-making machines now in use to permit such machines to produce a helical spring having squared end convolutions disposed wholly within planes substantially perpendicular to the axis of the spring. The mandrel is continuously rotatable and is movable along its axis of rotation except when such axial movement is arrested without interrupting its rotation to form the squared ends.

✦ ✦ ✦

No. 2,119,570, STRAND HANDLING APPARATUS, Patented June 7, 1938 by Samuel E. Brillhart, Towson, Md., assignor to Western Electric Company, Incorporated, New York, N. Y., a corporation of New York.

An extrusion press applies a coating of vulcanizable compound on the wire and an oven vulcanizes the coating, the wire passing directly from the press into the oven in a free catenary curve so that the coated wire is untouched until hardened.

✦ ✦ ✦

No. 2,119,847, COILING DEVICE, Patented June 7, 1938 by Karl Grube, Cleveland, Ohio, assignor to The American Steel and Wire Company of New Jersey, a corporation of New Jersey.

Complete Descriptions and Drawings of Patents May Be Had for 25 cents. Address, Wire & Wire Products, 17 East 42nd St., New York.

A continuous length of rope or the like is formed into a plurality of connected coils, each of which is moved, after it is formed, to a storing position, preparatory to the formation of a succeeding coil. Pivoted to the end flange of an elongate drum are fingers which project outwardly of the drum to form a coiling groove thereon.

✦ ✦ ✦

No. 2,119,889, PARTITION, Patented June 7, 1938 by Bernard S. Pease, Evanston, Ill., assignor to The American Steel and Wire Company, of New Jersey, a corporation of New Jersey.

For use in bottle cases, the collapsible partition comprises a first series of elongate parallel wire loops and a second series of loops at right angles to the first series, and which surround and squeeze upon the first series, the crossing points of the wires being in the form of cooperating offset seats.

✦ ✦ ✦

No. 2,119,890, PARTITION, Patented June 7, 1938 by Bernard S. Pease, Evanston, Ill., assignor to The American Steel and Wire Company of New Jersey, a corporation of New Jersey.

The crossing points of the perpendicular wires of this partition are in the form of cooperating offset seats, and the wires are held together without preventing relative rotation, by wire clips provided with eye loops disposed at right angles to each other and encircling the wires adjacent to the crossing points.

✦ ✦ ✦

No. 2,120,088, ARMORED CONDUCTOR, Patented June 7, 1938 by George Carlson, Bridgeport, Conn., assignor to General Electric Company, a corporation of New York.

In constructing cables provided with insulated conductors and with an uninsulated ground return conductor, to prevent kinking while the conductors are being twisted, and to prevent movement of the ground return when the cable is vertically installed, the uninsulated conductor is built up to the same diameter as the insulated conductors.

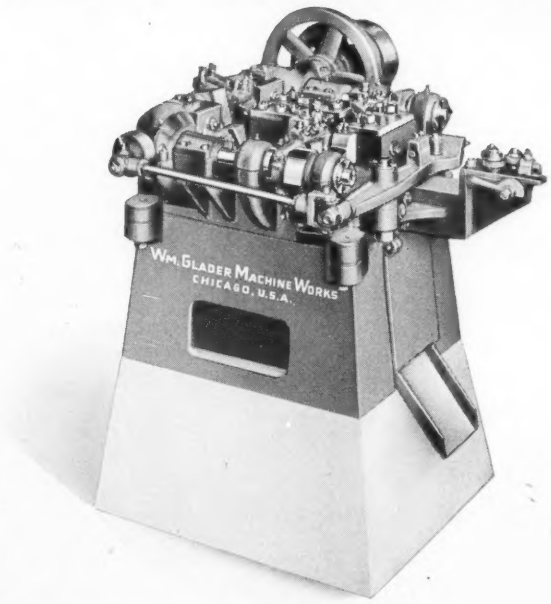
✦ ✦ ✦

No. 2,120,146, SPRING WINDING MACHINE, Patented June 7, 1938 by Elmer W. Halvorsen and Arthur C. Nigro, Torrington, Conn., assignors to The Torrington Manufacturing Company,

(Please turn to Page 418)

700 NAILS PER MINUTE

GLADER BRAD AND FINE NAIL MAKING MACHINE



This machine will produce nails and brads ¼" to 1⅛" in length from wire 22 gauge to 16 gauge inclusive.

The Glader machine is made in eleven different sizes. This enables us to cover any size of nail most efficiently.

For prices and further information address,

Wm. Glader Machine Works

210 No. Racine Ave.,
CHICAGO, ILLINOIS.

A Review of Recent Wire Patents

(Continued from Page 417)

Torrington, Conn., a corporation of Connecticut.

Rotatably driving a spindle on which torsion springs are wound is a mechanism permitting variations in the extent of winding. The machine provides for variations in the pitch of the springs, for driving the feed rolls, for severing the wire, forming its projecting ends and for removing completed springs from the spindle.

✦ ✦ ✦

No. 2,120,306, WIRE COVERING FOR HIGH FREQUENCY CIRCUITS, Patented June 14, 1938 by Raymond G. Zender, Chicago, Ill., assignor to Lenz Electric Manufacturing Co., Chicago, Ill., a corporation of Illinois.

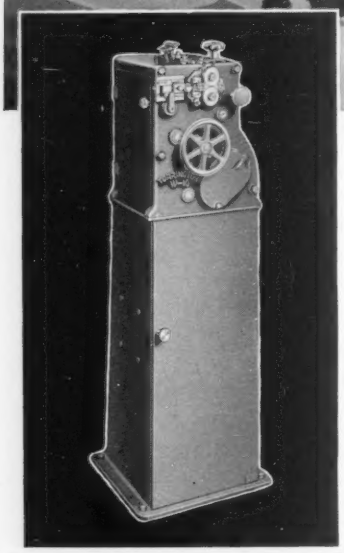
Covering the wire is a cellulose acetate textile impregnated with a petrolatum type wax devoid of acid and having a melting point of at least 155°F., the wax having a microcrystalline structure and the covering being free of coloring except for tracer threads which constitute less than 20% of the total textile volume of the covering.

✦ ✦ ✦

No. 2,121,403, WIRE ARTICLE, Patented June 21, 1938 by Joseph Lapinskas, Cicero, Ill.

A basket, receptacle, or similar article is formed of upper and lower ring-like units having wire loops interconnected so that the device is capable of assuming various shapes.

Unique architectural forms at the 1939 New York World's Fair Site dramatize modernism and the World of Tomorrow



INCREASE YOUR COIL SPRING PRODUCTION

You cannot afford to be without Torrington's new spring coiling machines which are producing big savings for spring makers — are revolutionizing present-day spring production—include patented features and improvements for minimum set-up time, greatly increased production. A new bulletin describes in detail these improved modern machines. Write for your copy today.

Spring Making Machines by

TORRINGTON

THE TORRINGTON MANUFACTURING COMPANY
TORRINGTON, CONNECTICUT • • • U. S. A.

No. 2,121,415, PROCESS FOR THE MANUFACTURE OF SHEETS, BANDS, TUBES, RODS, AND THE LIKE, AND IN PARTICULAR WIRE, Patented June 21, 1938 by Adolf vom Braucke, Berge, Germany.

Preparatory to cold working, the wire is rapidly heated to a temperature of 800° to 1300°C., then quenched to a temperature between 720° and 1050°C. and then to a temperature between 0° and 720°C., for the purpose of providing it with a coarse-grained structure.

✦ ✦ ✦

No. 2,121,527, METHOD AND MACHINE FOR PRODUCING COILED WIRE BUNCHES, Patented June 21, 1938 by George L. Mason, Warehouse Point, Conn., assignor to Springfield Wire & Tinsel Co., West Springfield, Mass., a corporation of Massachusetts.

One or more metallic strands preferably flattened into helical form are wound into skein form under tension to keep the coils stretched out. When the skein is removed from the winding reel, the coiled wire contracts so that the coils interlock and at the same time the skein as a whole contracts into the hand-size bunch which is desired for the final product (for cleaning utensils).

✦ ✦ ✦

Reissue No. 20,774, METHOD OF AND APPARATUS FOR CURLING STRAND MATERIAL, Patented June 28, 1938 by Reginald F. Sedgley, Philadelphia, Pa., assignor to John W. Gottschalk Manufacturing Co., Philadelphia, Pa., a corporation of Pennsylvania.

Onto a single revolving mandrel is passed a plurality of metallic strands, the first turn of each strand on the mandrel being subjected to the pressure of the yielding surface of a revoluble roll to curl each strand, after which the strands are withdrawn from the mandrel in the form of a single cord with adjacent coils of different strands interlocked and may then be bunched or skeined in any desired manner.

✦ ✦ ✦

No. 2,121,939, WIRE FABRIC, Patented June 28, 1938 by Charles G. Williams, Fairfield, Conn., assignor to American Chain & Cable Company, Inc., a corporation of New York.

The invention provides a highway guard fabric which will yield by structural deformation and also by stretch of the material of which it is composed, but which cannot be narrowed under impact so that after arresting a vehicle there will be no unsightly concavity requiring removal. Contiguous tension wires are interwoven with weft wires or pickets to produce a flat band wherein the marginal tension wires are secured to the weft wires and the intervening tension wires are free to slide relative to the weft wires.

✦ ✦ ✦

No. 2,122,043, METHOD OF PRODUCING CHARACTERS, Patented June 28, 1938 by John H. Pollard, Dallas, Tex., assignor of one-half to Arthur S. Barron and one-half to Richard Burdick, both of Dallas, Tex.

With the present method, a picture, character, symbol or letter may be formed upon open mesh fabric, such as is used in window screens. Over a sheet of decalcomania paper is placed a sten-

cil through the openings of which is forced a pigment or plastic compound to form a transfer sheet upon which the open mesh fabric is placed. Superjacent the open mesh fabric a second stencil is positioned through the openings of which a plastic compound is passed so as to adhere to the wire fabric and also contact the back of the characters on the transfer sheet. The decalcomania paper is then removed and the characters thereon remain attached to the plastic compound.

✦ ✦ ✦

No. 2,122,082, MEANS FOR FORMING WIRE HANDLES, Patented June 28, 1938 by Francis C. Bertram, Portland, N. Y.

In producing wire handles of the type used on fruit baskets, a forming die is provided, a portion of which is yieldable to permit the use of slack material for the forming of a plurality of bends in the wire handle in a single continuous operation without strain upon the metal of wire.

✦ ✦ ✦

Woven Wire Products

(*Continued from Page 398*)

tions to meet the exacting modern requirements. Simplicity, ease of operation, elimination of fire hazard and all around cleanliness combine for the most economical possible cost of production.

✦ ✦ ✦

AN exceedingly interesting experience at the plant of the California Wire Cloth Corporation is that, since the change was made to natural gas firing, the life of the costly "V" kettle has been lengthened materially. Previously, expensive replacements occurred at short intervals. Mr. DePoy gives natural gas full credit for this circumstance.

✦ ✦ ✦

Micromax Frequency Recorders And Indicators

A NEW 20-page catalog on "Micromax Frequency Recorders and Indicators" has just been issued by the Leeds & Northrup Company.

✦ ✦ ✦

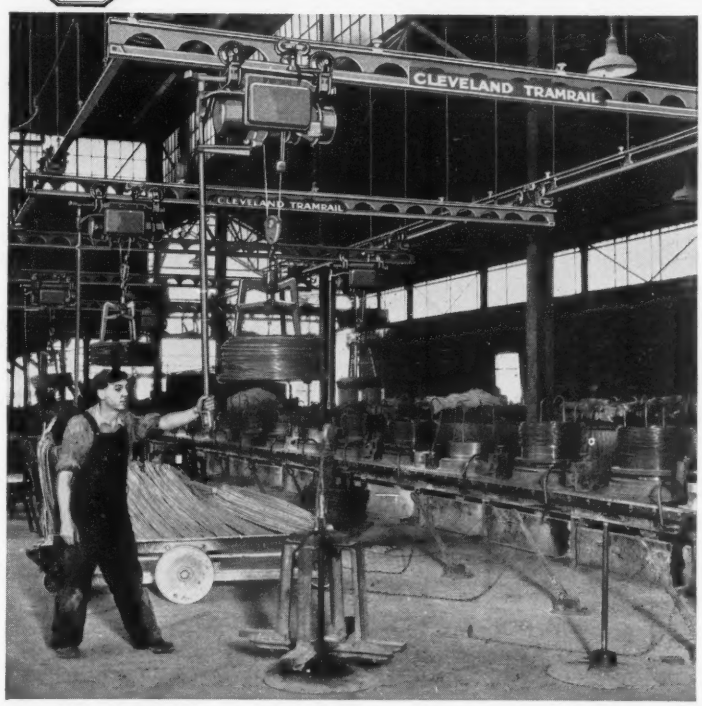
NOW that synchronous clocks and synchronous machinery are used so generally, **frequency measurement** is increasingly important not only to public utilities, but to industrial plants that generate their own power, and even to those that buy it. The subject, however, is one on which little literature has been published. In this booklet, therefore, the description of instruments is prefaced with a discussion of considerations responsible for the increasing use of equipment for frequency measurement and for frequency-load control. Illustrations show modern installations in steam, hydro and diesel plants, large and small, as well as in load dispatchers' offices and in laboratories.

Spring Machinery Bulletin

THE Torrington Manufacturing Company of Torrington, Connecticut has just released an attractive and colorful illustrated bulletin describing the advantages and features of its segment and clutch type spring making machines. Specifications for each type of spring making machine are shown in table form on the back page of the bulletin.

CLEVELAND TRAMRAIL

MATERIALS HANDLING EQUIPMENT



● **Block Stripping is just one of the diversified applications of Cleveland Tramrail in the Wire and Wire products industry.**

● **Others are rod storage, cleaning house, car loading and unloading, galvanizing departments, serving fence looms, package warehousing, etc.**

Consult your phone directory under Cleveland Tramrail.

CLEVELAND TRAMRAIL

Division of

THE CLEVELAND CRANE & ENGINEERING CO.

1141 Depot St.

WICKLIFFE, OHIO

The Manufacture of Spring Wire From Low Carbon Steel

(Continued from Page 410)

THE widely held belief that basic open-hearth steel is unsuitable for spring wire manufacture by this process is shown to be erroneous.

✦ ✦ ✦

NON-UNIFORMITY of hardening can be held down but not entirely eliminated. The practise of submerging the reel in water is favorable to uniformity. Finally, variations in tensile can be held to a small minimum by careful regulation of furnace, roll, and water temperatures.

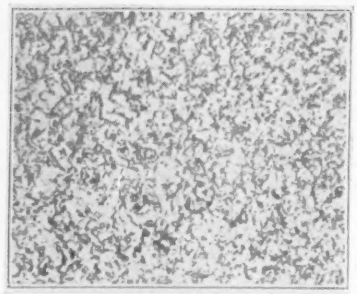


Fig. 16. Quenched low carbon steel wire drawn to 3.8 mm.

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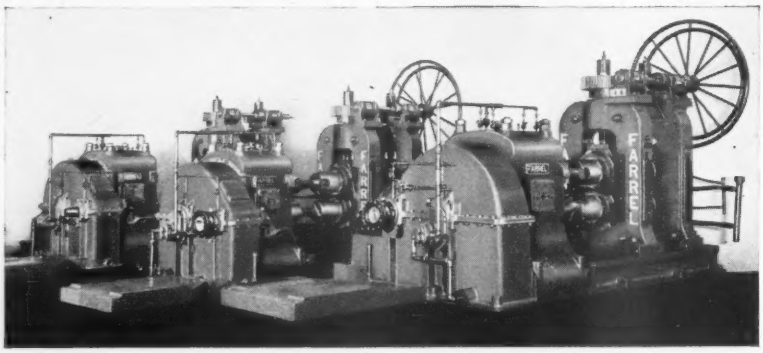

Rolling Copper Strip at 1000 feet per minute

The pressure of high labor costs and the shortened work week has intensified the search for increased output and lower production costs through improved mechanical equipment.

For the rolling of brass and copper strip Farrel has developed the high speed mill, which has stepped up the speed from the recent top of 250 feet per minute to 1000 feet per minute on copper and 750 feet per minute on brass.

Speeds as high as these require improved design and careful construction for maximum performance in continuous service. These qualities are built into Farrel Rolling Mills by advanced engineering, expert mechanics, modern plant facilities and a century of experience in building rolling mills and other heavy equipment.

Our engineers will be glad to explain the improved design and construction features of Farrel Rolling Mills which bring about higher operating efficiency, increased output, lower power consumption, minimum labor and maintenance costs and improved quality products.

Farrel-Birmingham Rolling Mill Equipment includes: Rolls — Rolling Mills — Rod Mill Tables and Manipulating Equipment — Universal Mill Spindles — Rod Coilers — Lead Presses for Pipe or Rod — Roll Grinding Machines — Roll Calipers — Gears — Mill Pinions — Pinion Stands — Drives up to 10,000 H.P. — Flexible Couplings.

FARREL-BIRMINGHAM
Company, Inc.
38 Main St., Ansonia, Conn.

Manufacturers of materials, tools and equipment for wire drawing and forming plants are constantly making improvements and additions to their lines. If you do not find the product or service in which you are interested, additional information will be supplied promptly. Simply address:

WIRE & WIRE PRODUCTS
17 East 42nd Street
New York City

(*Continued from Page 416*)

for wire products have been hardly more than 15% of what they were last year. The demand has been particularly satisfactory for wire nails and fencing wire. But it is uncertain whether this demand will continue. From all other markets the demand is more or less quiet. Only the Near East is buying, whereas the Far East is quiet. Business with European markets is dull and with Latin America normal.

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THE association of German wire mesh manufacturers has been investigating possibilities for changing the colours of wire mesh on the export market, but it appears that the customers have not fallen in with red, brown or black colours, advocated by a number of manufacturers. Now as before, green, blue and yellow are the colours preferred by the customers, though the demand for yellow is disappearing with blue gaining in favour. This concerns also all African markets.

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BUSINESS in sewing and other needles is dull and export turnovers are decreasing. In this line Japanese competition is very keen, Japanese needles being offered at remarkably low prices. It is not probable that an agreement will be possible with the Japanese industry.

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JAPANESE competition in some wire products is said to be reviving. Japanese manufacturers are hampered by very high wire rod prices and there is no discount given for export purposes. Therefore Japanese prices for wire products cannot be low, except in those markets to which freight rates from Japan are particularly attractive. It is reported, the quality of Japanese wire shows considerable improvement compared with the quality supplied previously.

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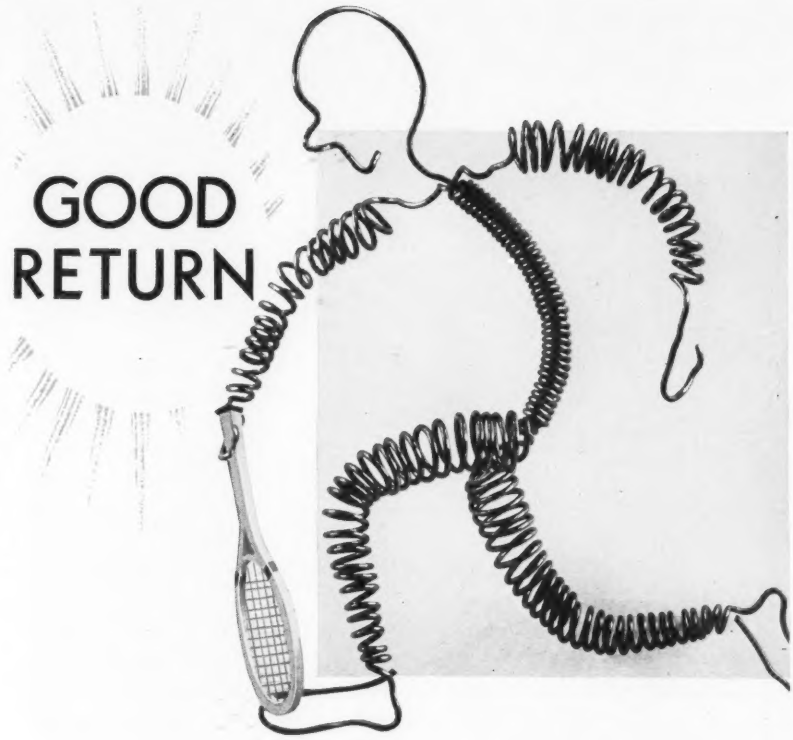
EXPORT business in wire machinery continues to be satisfactory. High quality machines, particularly multiple spindle wire

(*Please turn to Page 429*)



Keystone wire has slapped back many a difficult production problem. Our technical staff is good at that — developing wires to meet all sorts of unusual requirements. And then Keystone laboratory-controlled production delivers the goods with absolute uniformity.

Serve us an inquiry, and see what kind of return we make.

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HIGH CARBON
or
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SAMSON SPRING WIRE
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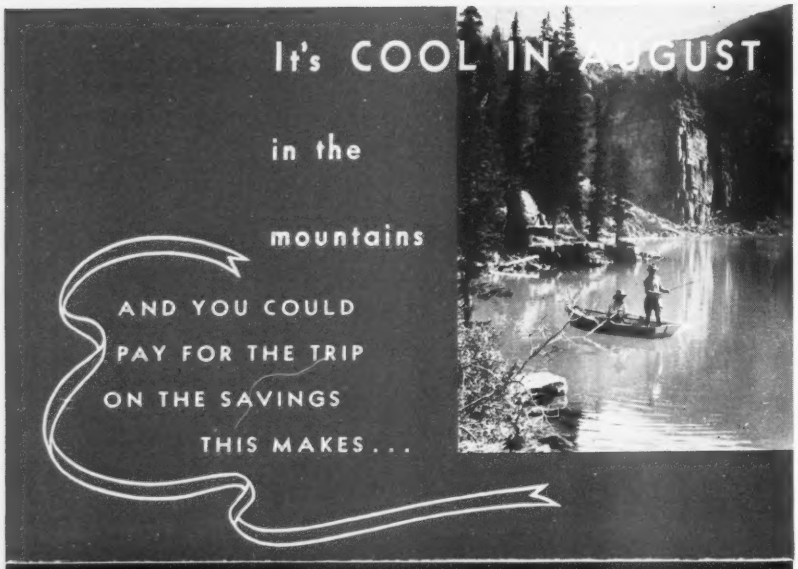
KEYSTONE STEEL & WIRE CO. PEORIA, ILL.

Bright . . . Tinned
Coppered
Annealed
Galvanized



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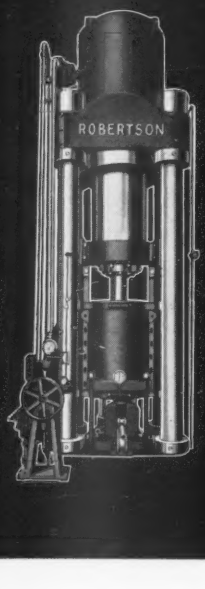


ROBERTSON LEAD ENCASING HYDRAULIC PRESS

JOHN ROBERTSON COMPANY, INC.
125-137 Water Street, Brooklyn, N. Y.

Joseph H. Carter, Vice President Of Operations, Pittsburgh Steel Co.

JOSEPH H. CARTER, since March, 1936, general superintendent of the Pittsburgh Steel Co., Pittsburgh, has been elected vice president in charge of operations, and a director of the company. Born in Harvey, Ill., in 1893, Mr. Carter was graduated from Rose Polytechnic institute in 1916. In that year he began as third helper in the Lowellville, O., open-hearth department of the Sharon Steel Corp. In 1929 he was made superintendent of the open-hearth department at Lowellville; in 1926 was promoted to assistant general superintendent of the Lowellville works; and in 1931 was elevated to general superintendent, a post held until last March when Henry R. Roemer, president of Pittsburgh Steel, took him to Pittsburgh.

✦ ✦ ✦

Corrosion-Resistant Chemical Equipment

THE Haveg Corporation of Newark, Delaware has recently issued two booklets which will be of interest to production men in the wire industry. One of them, Bulletin C-1, discusses in detail and gives constructional data on all types of Reaction, Absorption, Factionating, etc. Towers made of Haveg. Complete information is given on the physical and chemical properties.

✦ ✦ ✦

THE other, a general catalogue on Haveg Chemical Equipment, issued under the title of "Corrosion-Resistant Chemical Equipment," describes what Haveg is, together with its acid-resisting property, and outlines the composition of the various grades as well as their physical and chemical properties, and their design and application in the process industries.

✦ ✦ ✦

Jones & Laughlin Steel Corp. Wire Rope Plant

THE completion of a modern wire rope plant at Muncy, Lycoming County, Pennsylvania, as an additional unit of its ex-

pansion and development program has been announced by the Jones & Laughlin Steel Corporation, Pittsburgh.

✦ ✦ ✦

THIS new plant, to be known as the Gilmore Wire Rope Division of the Jones & Laughlin Steel Corporation, started operation about July 1st, 1938. It marks the entry of the Corporation into a new line of finished products including wire rope for oil country use, for general construction purposes and for industrial application.

✦ ✦ ✦

THE fabrication and sale of the products of the new plant are to be under the direction and supervision of Robert Gilmore, General Manager, whose offices will be at Muncy, Pennsylvania. His entire business experience has been in the wire rope field.

✦ ✦ ✦

Exports and Imports of Wire

(*Continued from Page 414*)

000 pieces, and this trade was covered by Japan 503,000 pieces; Germany 200,000 pieces; and Switzerland 103,000 pieces.

✦ ✦ ✦

IMPORTS of WIRE CLOTH AND SCREENING amounted to 22,517 square feet against 28,932 square feet, and the supplying countries were Germany 7,018 square feet; Canada 6,133 square feet; France 4,557 square feet; and the Netherlands 4,809 square feet.

✦ ✦ ✦

NO trade resulted in WIRE FENCING AND NETTING—galvanized before weaving—against 429,250 square feet in April. Of that galvanized after weaving, the total was 625,500 square feet against 643,500 square feet, and the outstanding countries of supply were Germany 262,500 square feet; and Belgium 360,000 square feet.

✦ ✦ ✦

RECEIPTS of FOURDRINIER AND OTHER PAPER-MAKING WIRES amounted to 22,841 square feet against 16,311 square feet, and came mainly from Germany 16,083 square feet; and France 6,139 square feet.

Nickel Silver: A Survey of Published Information

By T. F. Pearson, M. Sc.

Research Report R. R. A. 472 of The British Non-Ferrous Metals Research Association. Published May, 1938. 36 pp. Price 3s.

AS a preliminary to certain researches which the British Non-Ferrous Metals Research Association has in hand, the author made a careful examination of available information on nickel silver alloys. The results of his survey are set out in the present publication.

✦ ✦ ✦

AFTER a short introductory section, the specifications for nickel silver alloys issued in various countries are listed and discussed. Then follows a section devoted to the mechanical and physical properties of the alloys. Values for the mechanical properties in both cast and wrought forms and at various temperatures are noted, together with the endurance properties. Data on physical properties include thermal conductivity and electrical resistance, density, tarnish resistance, shrinkage and fluidity etc. The various aspects of melting and casting are next dealt with. Some casting defects are mentioned, and there is a short account of sands and sand moulding. The effects of impurities on behaviour in casting and working and on properties then receive attention, the impurities considered including lead, tin, manganese, aluminum, iron, silicon, carbon, phosphorus, magnesium, sulphur, oxygen, antimony and arsenic. Finally there are accounts of the working of the alloys (rolling, extrusion, jointing, cleaning and finishing) and of the effect of annealing. A select bibliography of nearly 90 items is provided, reference to which is made throughout the text.

This is an invitation for you to become a member of The Wire Association. ✦ ✦ ✦ ✦ ✦ ✦

The Annual Dues Are $10.00
AND INCLUDE

1. A subscription for the period of the membership to the designated official publication of the Association, "WIRE AND WIRE PRODUCTS."
2. A copy of the annual WIRE BUYERS GUIDE AND YEAR BOOK OF THE WIRE ASSOCIATION.
3. A copy of the proceedings and discussions held at the annual meeting.
4. Co-operative and helpful information on processes and methods of production.

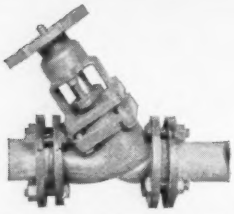
For Details Address

Richard E. Brown, Secretary,
The Wire Association
17 E. 42nd St., New York, N. Y.

13½ Miles of Spindles Gaged—Carboloy Gage Shows No Bearing Wear

LONG Carboloy gage life is reported by an Illinois manufacturing concern. Using a Carboloy ring gage of .1285 diameter, they have gaged 431,979 aluminum alloy spindles, each 2" long, with no measurable wear on the bearing of the gage. However, the bell or entrance of the gage was worn slightly, but required grinding of only .030" from both sides to recondition the gage for further use. The gage is made of solid Carboloy—13/32 outside diameter, 1/4" thick, with a .1285 diameter hole size. High speed steel gages formerly used wore oversize at from 3000 to 5000 spindles,—.12865 maximum allowable gage limit.

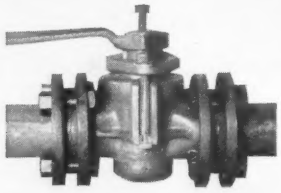
Make Your Plans Now to Attend
The Wire Association Meeting in
October, 1938 at Detroit, Mich.



Duriron Y Valve . . . acid-resisting . . . full opening . . . can't stick or score . . . all parts mechanically aligned . . . split flanges for Duriron pipe; companion flanges, lead or screwed pipe.

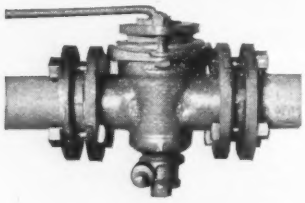
VALVES

for Acids

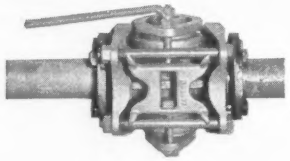


Nordstrom-type Valve . . . acid-resisting . . . has lubricant ducts . . . seating surface lubricated . . . no contact of acid with lubricant . . . useful with acids having no lubricating properties.

Type 600 Valve . . . acid-resisting . . . new type valve with lubricating features . . . head deeply recessed . . . lubricant travels in straight line . . . positive stop prevents exposure of ducts to acid handled.



"Plunger-Release" Valve . . . acid-resisting . . . plug valve with mechanical plug-releasing feature . . . valuable for handling acid sludges and solutions containing abrasives . . . flanges either malleable iron or stainless steel.



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IF you are making high carbon spring wire and getting less than 6000-9000 lbs. of .076 spring wire .55 carbon per 8 hour shift per man

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ALSO spring wire from unpatented rod in #8 to #12 gauge.

✦ ✦ ✦

For Detailed Information Address
Licensed Professional Engineer,
Box 705, c/o Wire & Wire Products,

17 E. 42nd St., NEW YORK, N. Y.

The Marino Electro-Galvanizing Process

A RECENT innovation in British galvanizing practice has been the introduction of the Marino process for electro-galvanizing iron or steel wire or shapes.

✦ ✦ ✦

THE process is based upon the use of a special apparatus and the plant will deal with all kinds of wire or rods from half inch rods to the finest wire. Special electrodes are used to take care of large amounts of current and deal with large quantities in a short time.

✦ ✦ ✦

IT is claimed for the process that the coating produced is of the first quality, adherent, smooth, uniform, free from porosity and that the coatings will meet all specifications; Admiralty; B.S.S.; N. 443 in England, or the equivalent specifications in America.

✦ ✦ ✦

IT is further claimed for the process that there is no loss of zinc by oxidization and no dross formed. Further, that the plant itself is healthful, clean and better for the employees. The process has been used in England for galvanizing high strength wire with a tensile of 100 to 140 tons and over per square inch. It is further claimed by the owners of the process that all coatings of pure zinc made by this process will stand exposure to atmospheric conditions longer or exposure to acid fumes, salt water to a greater degree than any other form of galvanizing, and that in the event of the wire coming into contact with salt water or water containing other chlorides, or magnesium sulphates, no local action will result and the zinc will not dissolve away.

✦ ✦ ✦

Handbook on Cold Drawn Steels

THE Union Drawn Steel Division of Republic Steel Corporation, Cleveland, Ohio, announces a 24-page illustrated handbook entitled, "Cutting Costs with Cold Drawn Steel". This is a non-technical discussion of the results of cold drawing and their utilization in the manufacture of steel parts.

HAVE YOU A PATENT, A PROCESS OR AN INVENTION APPLICABLE TO THE WIRE INDUSTRY YOU DESIRE TO SELL OUTRIGHT OR TO PLACE ON A ROYALTY BASIS?

✦ ✦ ✦

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Box 112

Wire & Wire Products

17 E. 42ND. ST.

NEW YORK, N. Y.

Farrel-Birmingham Issues Latest Information On Gears

VALUABLE information on the various types of speed reducing and speed increasing gear units and related products manufactured by Farrel-Birmingham Company, Inc., Buffalo, N. Y., is contained in a new 80-page illustrated catalog just published by the company.

✦ ✦ ✦

THIS catalog discusses herringbone gears and their advantages for transmitting power and transforming speed between parallel shafts. It explains how the introduction of the Sykes process for generating continuous herringbone teeth and its development by the Farrel - Birmingham Company opened the way to an enormous expansion in the use of herringbone gears for nearly every conceivable application.

✦ ✦ ✦

THE new catalog contains twenty illustrated pages describing a complete series of gear units of the speed reducing type, accompanied by tables of horsepower ratings, service factors, overhung load capacities, dimensions and weights. Similar descriptive and engineering data are given on speed increasing units, vertical reduction units of the horizontal shaft type and right angle vertical shaft drives.

✦ ✦ ✦

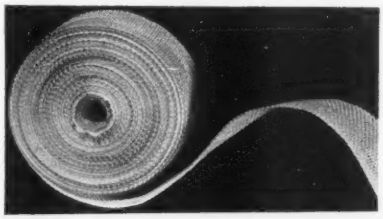
IN addition, many special purpose units are illustrated and described. Among these are high-ratio drives, multi-speed gear units, right angle horizontal shaft units, rolling mill drives and pinion stands, dredge drives and marine propulsion units. Data on Gearflex Couplings of the double engagement type, which are used for connecting the gear units with their driving motors and driven machines, are also given.

✦ ✦ ✦

THERE is also included a description of the machines and process by which the continuous tooth herringbone gears are generated; an instructive chapter on gear design and many photographic illustrations of Farrel-Sykes gear installations.

Glass Insulating Tapes

NEW electrical insulating tapes, woven entirely from glass yarns, have recently been developed by the Corning Glass Works, Corning, N. Y. These tapes, with the appearance and flexibility of ordinary textiles, are intended for the insulation of coils for motors, generators, transformers, and for cables and other electrical conductors. As they are composed solely



of glass, they not only have exceptional electrical properties and chemical resistance, but have the ability to withstand temperatures far in excess of the limits specified for class B High Temperature Insulation. They impregnate readily with resins, gums, and varnishes to form an insulation impervious to moisture and of high dielectric strength.

✦ ✦ ✦

THE flexibility and textile properties of these tapes are obtained from the extreme fineness of the glass fibres, which is from 1/15 to 1/20 the diameter of a human hair.

WHOEVER UNDERSTANDS GERMAN

Should Read

"Draht-Welt" (Wire World)

A weekly for the wire industry and related lines.

Subscription price: Rm. 6.50 quarterly

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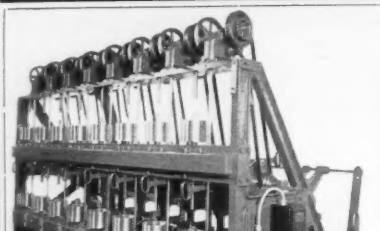

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a NEW, LATEST type of Diamond Die, just now on the market besides the usual regular type. Write us for information.
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Electricity's Finger-prints Improve High Voltage Cables

MICROPHYSICAL and microchemical methods are employed in "crime" detection by Dr. H. H. Race of the General Electric Research Laboratory at Schenectady. The culprits are electrons or ions and the crime is the destruction of electric cables undergoing severe laboratory tests.

✦ ✦ ✦

FOR several years Dr. Race has been working in the Schenectady Laboratory with miniature samples of high-voltage oil-impregnated paper-insulated cables. Under high-voltage stresses, electronic or ionic bombardment of the paper causes it to carbonize and burn through, layer by layer, leaving behind the culprit's finger-prints. An examination of the paper will show, for instance, how the bombardment pounded away at the paper, branching out over its surface until the ions or electrons eventually found a weak spot and burned through, only to begin operations again on the next layer of paper. As these agents of destruction progress through the layers of paper they tend to spread out, damaging larger areas until complete electrical failure occurs. With the damaging evidence available, the identity of the culprits is unquestionable and the laboratory investigator can thereby assist the engineer in improving cable design.

✦ ✦ ✦

PREVIOUS to the type of experiments with miniature samples now being conducted in the Schenectady laboratory only full-sized lengths of cable could be tested. By the new method, life test data have already been obtained on many hundreds of different combinations of oils, papers and designs; and analyses of these data are giving a good understanding of the direction cable research should take in the endeavor to obtain improved products.

✦ ✦ ✦

LARGE electric cables, operating at thousands of volts, form the main arteries by which millions of kilowatt-hours of electric energy are conducted from power to distributing stations in the big cities

of this country. To insure an increasingly better quality for such cables so they will operate faultlessly for decades is the goal of research engineers.

✦ ✦ ✦

THE combination of pure mineral oil and wood-pulp paper from which water, air and other contaminants have been very carefully removed makes the best flexible high-voltage electric insulation cable yet discovered. In building a cable, many layers of paper are wrapped on the copper core in strips only a few thousandths of an inch thick. This paper is then carefully dried and impregnated with oil.

✦ ✦ ✦

IN improving such cables, much importance is attached to the researches in which miniature specimens made in the laboratory under the most carefully controlled conditions are subjected to much more severe conditions than will ever be expected of a cable in service. Such experiments are much less expensive than the large-scale tests; thus, the number of combinations of materials and conditions that can be investigated is correspondingly much greater. It is from hundreds of such experiments that scientists seek to learn how the best possible combination of materials can be assembled to make cables which shall supply electrical life blood to all industries and inhabitants of our metropolitan districts.

✦ ✦ ✦

ONE instrument used in the investigation illustrates the minuteness which such miniature tests demand. It was developed so that the electrical condition of each layer of a cable sample can be studied after it has been subjected to severe electrical tests. The electrical quality of one drop of oil can be measured with this device and, as a cable specimen is dissected for investigation, a few square inches from one layer of paper are enough to yield this quantity of oil. By such means, incipient deterioration, which, in long service, might lead to failure, can be detected, and the causes can be diagnosed and corrected.

Learn about PARALAN

Paralan will give your finished wire and wire products protection from atmospheric corrosion in the mill and in shipping. Paralan-coated wire can be spot welded or soldered without cleaning. Also, Paralan leaves surfaces in good condition for all types of finishes—enameling, japanning, lacquering, plating, etc.

Write for further information. We may be able to solve your difficulties.

AMERICAN LANOLIN CORP.
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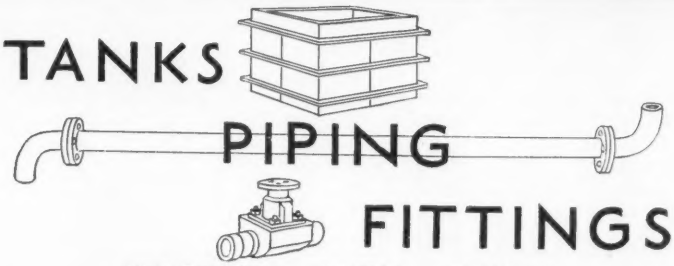
TANKS
PIPING
FITTINGS



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Electric Controller & Mfg. Co. Booklet

THE Electric Controller and Manufacturing Company of Cleveland, Ohio, has issued a very interesting booklet entitled, "We Raised Our Power Factor and Save $900 a Year."

✦ ✦ ✦

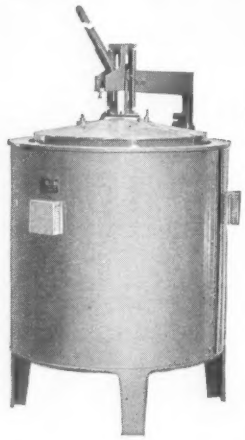
THIS booklet is a case study, showing how the E. C. & M. Company took advantage of the premium costs (for improved power factor) in the power company rules, and saved about $900 a year.

✦ ✦ ✦

IT contains a very interesting discussion as to the qualities of pure power factor, and the corrective devices necessary to effect material savings in cost. It also contains an explanation as to how the automatic power factor regulator operates.

The Homo Method for Tempering

A COPY of a new, profusely-pictured 36-page catalog, describing the Homo method for tempering, may be obtained by addressing Leeds & Northrup Company, 4934 Stenton Avenue, Philadelphia, Pa. In this new book are shown many varieties of work now being tempered, annealed or normalized in modern Homo furnaces.



Reproductions of actual chart records demonstrate the uniformity of Homo heat distribution throughout loads, formerly considered difficult to heat evenly. A cutaway furnace and diagrammatic drawings show the unique Homo design and construction which makes possible this uniformity. And for the first time, a single publication pictures and describes the complete line of modern Homo furnaces . . . for production tempering and for tool tempering; for large and for small loads; for vertical and for horizontal loading; for top efficiency on dense, on semi-dense and on open loads.

Make Your Plans Now
To Attend
The Wire Association Meeting
In October, 1938 at
Detroit, Mich.

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✦ ✦ ✦

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311 Main St. Worcester, Mass.

Biggest Safety Pin in the World

EVERYONE today is putting in their claim to the biggest something or other; from the biggest city, building, ship, train or dam to the biggest debt. The Copper & Brass Research Association nominates as its entry the biggest safety pin in the world. This pin, which is made of nickel-plated brass, is 37 inches high and weighs six-and-one-quarter pounds. It contains enough metal to make 4,400 average size pins or 18,000 tiny ones.

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1—24-16" Block Wire Drawing Machine
8—Shuster Automatic S. & C. Machines 1/32", 1/8", 3/16", 1/4", 3/8", 1/2", also 1/2", 7/8" square wire, motor driven.
Wanted: Tack making machinery.
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News of the World

(*Continued from Page 421*)

drawing machines are in large demand. American competition is not very active, as the American prices are maintained consistently. The German manufacturers report a further increase of unfilled orders. A large proportion of exported wire machines are at present bought in Europe. The present demand of barbed wire machinery, which in 1937 had been very large, is small, whereas wire netting machines are selling best. The demand for Bolt, Nut and Screw machines is also satisfactory.

All Sizes of
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WIRE, WIRE ROPE AND ELECTRIC CABLE MACHINERY
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Straightener Specialists Since 1866

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WHERE TO BUY

For more complete information, consult the annual Directory, Index & Buyers' Guide.

ABRASIVES—
Norton Co., Worcester, Mass.

ANNEALING POTS AND BOXES—
Scudder, E. J., Fdry. & Machine Co., Trenton, N. J.

ANTI-RUST—
Magnus Chemical Co., Garwood, N. J.

ARMORING EQUIPMENT—
American Insulating Mach'y. Co., Phila., Pa.
New England Butt, Co., Providence, R. I.
Sleeper & Hartley, Worcester, Mass.
Watson Machine Co., Paterson, N. J.

BAKERS—Rod and Wire
Morgan Construction Co., Worcester, Mass.

BORON CARBIDE—
Norton Co., Worcester, Mass.

CEMENT FLOOR CLEANER—
Magnus Chemical Co., Garwood, N. J.

CEMENTS—Refractory
Norton Co., Worcester, Mass.

CHEMICALS—Cleaning
American Chemical Paint Co., Ambler, Pa.
Magnus Chemical Co., Garwood, N. J.

CLEANERS—Hand and Metal
Magnus Chemical Co., Garwood, N. J.

CLEANING & PICKLING EQUIPMENT—
Broden Construction Co., Cleveland, O.
Duriron Co., The, Dayton, O.
Haveg Corp., Newark, Del.
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

COATING—Protective
American Lanolin Corp., Lawrence, Mass.

COILERS—Sheet, Strip and Wire
Broden Construction Co., Cleveland, O.
H. J. Ruesch Machine Co., Newark, N. J.
Torrington Mfg. Co., The, Torrington, Conn.

CONDUITS—Iron and Steel
Youngstown Sheet & Tube Co., Youngstown, Ohio.

CONTROLS—Automatic
Leeds & Northrup Co., Philadelphia, Pa.

CRANES—Wire Mill
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

DIAMOND TOOLS—
Rusch Wire Die Corp., New York, N. Y.

DIES—Diamond
Cochaud Wire Die Co., New York, N. Y.
Driver-Harris Co., Harrison, N. J.
Kelly Wire Die Corp., New York, N. Y.
Master Wire Die Corp., New York, N. Y.
Rusch Wire Die Corp., New York, N. Y.
Vianney Wire Die Works, New York, N. Y.

DIES—Lead Extrusion
John Robertson Co., Brooklyn, N. Y.

DIES—Repairs & Re-Cutting
Carboloy Co., Inc., Detroit, Mich.
Cochaud Wire Die Corp., New York, N. Y.
Firth-Sterling Steel Co., McKeesport, Pa.
Kelly Wire Die Corp., New York, N. Y.
Master Wire Die Corp., New York, N. Y.
Rusch Wire Die Corp., New York, N. Y.
Vianney Wire Die Works, New York, N. Y.

DIES—Rod and Tube Drawing
Carboloy Co., Inc., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Kelly Wire Die Corp., New York, N. Y.
Master Wire Die Corp., New York, N. Y.
Rusch Wire Die Corp., New York, N. Y.
Vianney Wire Die Works, New York, N. Y.

DIES—Tantalum Carbide
Carboloy Co., Inc., Detroit, Mich.
Kelly Wire Die Corp., New York, N. Y.
Master Wire Die Corp., New York, N. Y.
Rusch Wire Die Corp., New York, N. Y.
Vianney Wire Die Works, New York, N. Y.

DIES—Tungsten Carbide
Carboloy Co., Inc., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Master Wire Die Corp., New York, N. Y.
Rusch Wire Die Corp., New York, N. Y.
Vianney Wire Die Works, New York, N. Y.

DRAW BENCHES—
H. J. Ruesch Machine Co., Newark, N. J.
Scudder, E. J., Fdry. & Machine Co., Trenton, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.

ENGINEERS—Consulting Wire Mill
Lewis, Kenneth B., New York, N. Y.
Hartley, George D., Worcester, Mass.

WHERE TO BUY, Continued

EQUIPMENT—Insulation Testing
Leeds & Northrup Co., Philadelphia, Pa.

EYELETS—Brass or Zinc
Platt Bros. & Co., The, Waterbury, Conn.

FILLERS—Paper for Cable
E. W. Twitchell, Inc., Phila., Pa.

FURNACE CONTROLS — Combustion
Leeds & Northrup Co., Philadelphia, Pa.

FURNACE CONTROLS—Draft
Leeds & Northrup Co., Philadelphia. Pa.

FURNACES—Annealing
Electric Furnace Co., Salem, O.
Leeds & Northrup Co., Philadelphia, Pa.

FURNACES—Automatic
Electric Furnace Co., Salem, O.
Leeds & Northrup Co., Philadelphia, Pa.

FURNACES—Bright Annealing
Electric Furnace Co., Salem, O.
Hayes, C. I., Inc., Providence, R. I.

FURNACES—Electric
Electric Furnace Co., Salem, O.
Hayes, C. I., Inc., Providence, R. I.

FURNACES—Hardening and Tempering
Electric Furnace Co., Salem, O.
Hayes, C. I., Inc., Providence, R. I.
Leeds & Northrup Co., Philadelphia, Pa.

FURNACES—Lead Melting
Electric Furnace Co., Salem, O.
John Robertson Co., Brooklyn, N. Y.

FURNACES—Non-Oxidizing
Electric Furnace Co., Salem, O.

FURNACES—Normalizing
Electric Furnace Co., Salem, O.
Leeds & Northrup Co., Philadelphia, Pa.

FURNACES—Wire, Strip & Sheet
Electric Furnace Co., Salem, O.

GRINDERS—Roll
Norton Co., Worcester, Mass.

HANDLING EQUIPMENT — Material
Cleveland Tramrail Div. of The Cleveland Crane & Engineering Co., Wickliffe, O.

HOISTS—Monorail
Cleveland Tramrail Div. of The Cleveland Crane & Engineering Co., Wickliffe, O.

INHIBITORS
American Chemical Paint Co., Ambler, Pa.

INSTRUMENTS—Electrical
Leeds & Northrup Co., Philadelphia, Pa.

INSULATION — Cable or Cable Filler
E. W. Twitchell, Inc., Phila., Pa.

LATHES—Die Reaming
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

LUBRICANTS—For Metal Cutting, Stamping and Drawing
Magnus Chemical Co., Garwood, N. J.

LUBRICANTS—Wire Drawing
Magnus Chemical Co., Garwood, N. J.

MACHINERY—Armoring (Cable, Wire Hose)
Amer. Insulating Mach'y Co., Phila., Pa.
John Robertson Co., Brooklyn, N. Y.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Thomson-Judd Wire Machinery Co., Lynn, Mass.
Torrington Mfg. Co., The, Torrington, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Braiding
Fidelity Machine Co., Philadelphia, Pa.
New England Butt, Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Brazing
Thomson-Judd Wire Machinery Co., Lynn, Mass.

MACHINERY—Bunching
Amer. Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Watson Machine Co., Paterson, N. J.

MACHINERY—Bundling, Scrap
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.
Watson Machine Co., Paterson, N. J.

MACHINERY—Cable, Electric
Amer. Insulating Mach'y Co., Phila., Pa.
Fidelity Machine Co., Philadelphia, Pa.
New England Butt, Co., Providence, R. I.
Thomson-Gibb Electric Welding Co., Lynn, Mass.
Torrington Mfg. Co., The, Torrington, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Chain Making
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Closing
New England Butt Co., Providence, R. I.
Torrington Mfg. Co., The, Torrington, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Coil Winding
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., The, Torrington, Conn.

MACHINERY—Coilers
Broden Construction Co., Cleveland, O.
Farrel-Birmingham Co., Ansonia, Conn.
Morgan Construction Co., Worcester, Mass.
New England Butt Co., Providence, R. I.
H. J. Ruesch Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., The, Torrington, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Copper Wire Drawing and Rolling
Farrel-Birmingham Co., Ansonia, Conn.
H. J. Ruesch Machine Co., Newark, N. J.
Torrington Mfg. Co., The, Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Cutting
Broden Construction Co., Cleveland, O.
Farrel-Birmingham Co., Ansonia, Conn.
Hallden Machine Co., Thomaston, Conn.
Lewis Machine Co., The, Cleveland, O.
National Machinery Exchange, New York, N. Y.
F. B. Shuster Co., New Haven, Conn.
W. A. Schuyler, New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Enameling
Amer. Insulating Mach'y Co., Phila., Pa.

MACHINERY—Extruding
John Robertson Co., Brooklyn, N. Y.
Royle, John & Sons, Paterson, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Flat Wire
Broden Construction Co., Cleveland, O.
H. J. Ruesch Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., The, Torrington, Conn.

MACHINERY—Forming
National Machinery Exchange, New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., The, Torrington, Conn.

MACHINERY—Galvanizing Wire
Broden Construction Co., Cleveland, O.
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Gang Winders
Fidelity Machine Co., Philadelphia, Pa.
H. J. Ruesch Machine Co., Newark, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Grinding
Norton Co., Worcester, Mass.

MACHINERY—Insulating
Amer. Insulating Mach'y Co., Phila., Pa.
Fidelity Machine Co., Philadelphia, Pa.
New England Butt, Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Lead Encasing Presses, etc.
John Robertson Co., Brooklyn, N. Y.

MACHINERY—Lead Stripping
John Robertson Co., Brooklyn, N. Y.
Watson Machine Co., Paterson, N. J.

MACHINERY—Lock Washer
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Magnet Wire
Amer. Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., The, Torrington, Conn.

MACHINERY — Measuring Wire & Cable
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Nail and Tack
Glader, Wm., Machine Works Co., Chicago, Ill.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Panning
Amer. Insulating Mach'y Co., Phila., Pa.

MACHINERY—Pointing
Broden Construction Co., Cleveland, O.
H. J. Ruesch Machine Co., Newark, N. J.
Scudder, E. J., Fdry. & Machine Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., The, Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Rod Mill
Broden Construction Co., Cleveland, O.
Farrel-Birmingham Co., Ansonia, Conn.
Morgan Construction Co., Worcester, Mass.
H. J. Ruesch Machine Co., Newark, N. J.
W. A. Schuyler, New York, N. Y.

MACHINERY—Rolling Mill
Broden Construction Co., Cleveland, O.
Farrel-Birmingham Co., Ansonia, Conn.
Morgan Construction Co., Worcester, Mass.
H. J. Ruesch Machine Co., Newark, N. J.
Torrington Mfg. Co., The, Torrington, Conn.

MACHINERY—Rubber Strip Covering
Farrel-Birmingham Co., Ansonia, Conn.
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Rubber Tubing and Straining
Farrel-Birmingham Co., Ansonia, Conn.
New England Butt Co., Providence, R. I.
Royle, John, & Sons, Paterson, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., The, Torrington, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Screw Wire
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Special
Amer. Insulating Mach'y Co., Phila., Pa.
Broden Construction Co., Cleveland, O.
New England Butt Co., Providence, R. I.
H. J. Ruesch Machine Co., Newark, N. J.
Scudder, E. J., Fdry. & Machine Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., The, Torrington, Conn.
Watson Machine Co., Paterson, N. J.

WHERE TO BUY, Continued

MACHINERY— Special — Combination Machine for Drawing, Cutting-to-length. Straightening and Reeling Bars from Coil in One Operation (Shumag Type)—
W. A. Schuyler, New York, N. Y.

MACHINERY—Spooling
Amer. Insulating Mach'y Co., Phila., Pa.
Fidelity Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley Inc., Worcester, Mass.
Torrington Mfg. Co., The, Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Watson Machine Co., Paterson, N. J.

MACHINERY—Spring Making
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., The, Torrington, Conn.

MACHINERY—Staple
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Straightening
Broden Construction Co., Cleveland, O.
Hallden Machine Co., Thomaston, Conn.
Lewis Machine Co., The, Cleveland, O.
National Machinery Exchange, New York, N. Y.
H. J. Ruesch Machine Co., Newark, N. J.
W. A. Schuyler, New York, N. Y.
F. B. Shuster, New Haven, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., The, Torrington, Conn.

MACHINERY—Stranding
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Thomson-Judd Wire Machinery Co., Lynn, Mass.
Torrington Mfg. Co., The, Torrington, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Strip Steel
Broden Construction Co., Cleveland, O.
H. J. Ruesch Machine Co., Newark, N. J.
Torrington Mfg. Co., The, Torrington, Conn.

MACHINERY—Swaging
H. J. Ruesch Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., The, Torrington, Conn.

MACHINERY—Taping
Amer. Insulating Mach'y Co., Phila., Pa.
Fidelity Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Thomson-Judd Wire Machinery Co., Lynn, Mass.
Torrington Mfg. Co., The, Torrington, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Testing Size of Wire
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Tinsel Rolling Mills
Amer. Insulating Mach'y Co., Phila., Pa.

MACHINERY—Trolley Wire
Vaughn Machinery Co., Cuyahoga Fall, O.

MACHINERY—Tube Mill
H. J. Ruesch Machine Co., Newark, N. J.
Torrington Mfg. Co., The, Torrington, Conn.

MACHINERY—Welding Wire
Micro Products Co., Chicago, Ill.
F. B. Shuster Co., New Haven, Conn.
Thomson-Judd Wire Machinery Co., Lynn, Mass.

MACHINERY—Winding
Amer. Insulating Mach'y Co., Phila., Pa.
Fidelity Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., The, Torrington, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wire Drawing
Aetna-Standard Engineering Co., Youngstown, O.
Amer. Insulating Mach'y Co., Phila., Pa.
Broden Construction Co., Cleveland, O.
Morgan Construction Co., Worcester, Mass.
H. J. Ruesch Machine Co., Newark, N. J.
Scudder, E. J., Fdry. & Machine Co., Trenton, N. J.
W. A. Schuyler, New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Thomson-Judd Wire Machinery Co., Lynn, Mass.
Torrington Mfg. Co., The, Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Wire Rope
New England Butt Co., Providence, R. I.
Thomson-Judd Wire Machinery Co., Lynn, Mass.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wire Tinning
Amer. Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.

MACHINERY—Wrapping Wire
W. A. Schuyler, New York, N. Y.

MATERIAL HANDLING EQUIPMENT—
Cleveland Tramrail Div. of The Cleveland Crane & Engineering Co., Wickliffe, O.

MILLS—Tandem Rolling and Edging
Torrington Mfg. Co., Torrington, Conn.

NICKEL SILVER AND PHOSPHOR BRONZE—Rod, Wire and Strip
Hudson Wire Co., Ossining, N. Y.
Seymour Mfg. Co., Seymour, Conn.

PAPER—Insulating
E. W. Twitchell, Inc., Phila., Pa.

PATENT ATTORNEYS—
Lancaster, Allwine and Rommel, Washington, D. C.

PICKLING COMPOUNDS—
American Chemical Paint Co., Ambler, Pa.

PIPING AND FITTINGS—Acid Resistant
Haveg Corp., Newark, Del.

POTS—Lead Melting
Farrel-Birmingham Co., Ansonia, Conn.
John Robertson Co., Brooklyn, N. Y.

PRESSES—Hydraulic and Mechanical
John Robertson Co., Brooklyn, N. Y.

PRESSES—Lead
John Robertson Co., Brooklyn, N. Y.

PULLERS—Wire
Scudder, E. J., Fdry. & Machine Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.

PUMPS—Hydraulic
John Robertson Co., Brooklyn, N. Y.

PYROMETERS—
Leeds & Northrup Co., Philadelphia, Pa.

RECORDERS—
Leeds & Northrup Co., Philadelphia, Pa.

REEL AND TENSION STAND—
Fidelity Machine Co., Philadelphia, Pa.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., The, Torrington, Conn.

REEL CRUTCHES—
Watson Machine Co., Paterson, N. J.

REELS AND SPOOLS—Shipping and Shop
Apco-Mossberg Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, O.

REFRACTORIES—High Temperature
Norton Co., Worcester, Mass.

RODS—Wire—Non Ferrous
Hudson Wire Co., Ossining, N. Y.
Platt Bros. & Co., The, Waterbury, Conn.
Seymour Mfg. Co., Seymour, Conn.

RODS—Wire—Steel
Keystone Steel & Wire Co., Peoria, Ill.
Republic Steel Corp., Cleveland, O.
Youngstown Sheet & Tube Co., Youngstown, Ohio.

ROLLS—
Farrel-Birmingham Co., Ansonia, Conn.

RUST PROOF COMPOUND—
American Lanolin Co., Lawrence, Mass.

SHEET—Steel
Republic Steel Corp., Cleveland, O.
Youngstown Sheet & Tube Co., Youngstown, Ohio.

SKIN PROTECTOR—
Magnus Chemical Co., Garwood, N. J.

SOAPS—Industrial and Wire Drawing
Magnus Chemical Co., Garwood, N. J.

STRIP—Brass and Non Ferrous
Hudson Wire Co., Ossining, N. Y.
Seymour Mfg. Co., Seymour, Conn.

STRIP—Steel
Firth-Sterling Steel Co., McKeesport, Pa.
Republic Steel Corp., Cleveland, O.

TANKS—Compound
Watson Machine Co., Paterson, N. J.

TANKS—Pickling
Haveg Corp., Newark, Del.

TRAMRAIL SYSTEMS—
Cleveland Tramrail Div. of The Cleveland Crane & Engineering Co., Wickliffe, O.

TREADS—Safety
Norton Co., Worcester, Mass.

TRUCKS
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Fall, O.

TUBE BENDERS AND FORMERS—
H. J. Ruesch Machine Co., Newark, N. J.

VALVES AND FITTINGS—Acid Proof
Duriron Co., The, Dayton, O.
Haveg Corp., Newark, Del.

VULCANIZERS—
Watson Machine Co., Paterson, N. J.

VULCANIZING PANS—
Amer. Insulating Mach'y Co., Phila., Pa.

WELDERS—Spot and Butt
Micro Products Co., Chicago, Ill.

WIRE—Cold Heading
Keystone Steel & Wire Co., Peoria, Ill.
Republic Steel Corp., Cleveland, O.
Youngstown Sheet & Tube Co., Youngstown, Ohio.

WIRE—Electric
Hudson Wire Co., Ossining, N. Y.
Seymour Mfg. Co., Seymour, Conn.

WIRE—Enameled For Coils
Winsted Div. of Hudson Wire Co., Winsted, Conn.

WIRE—Manufacturers
Keystone Steel & Wire Co., Peoria, Ill.
Republic Steel Corp., Cleveland, O.
Youngstown Sheet & Tube Co., Youngstown, Ohio.

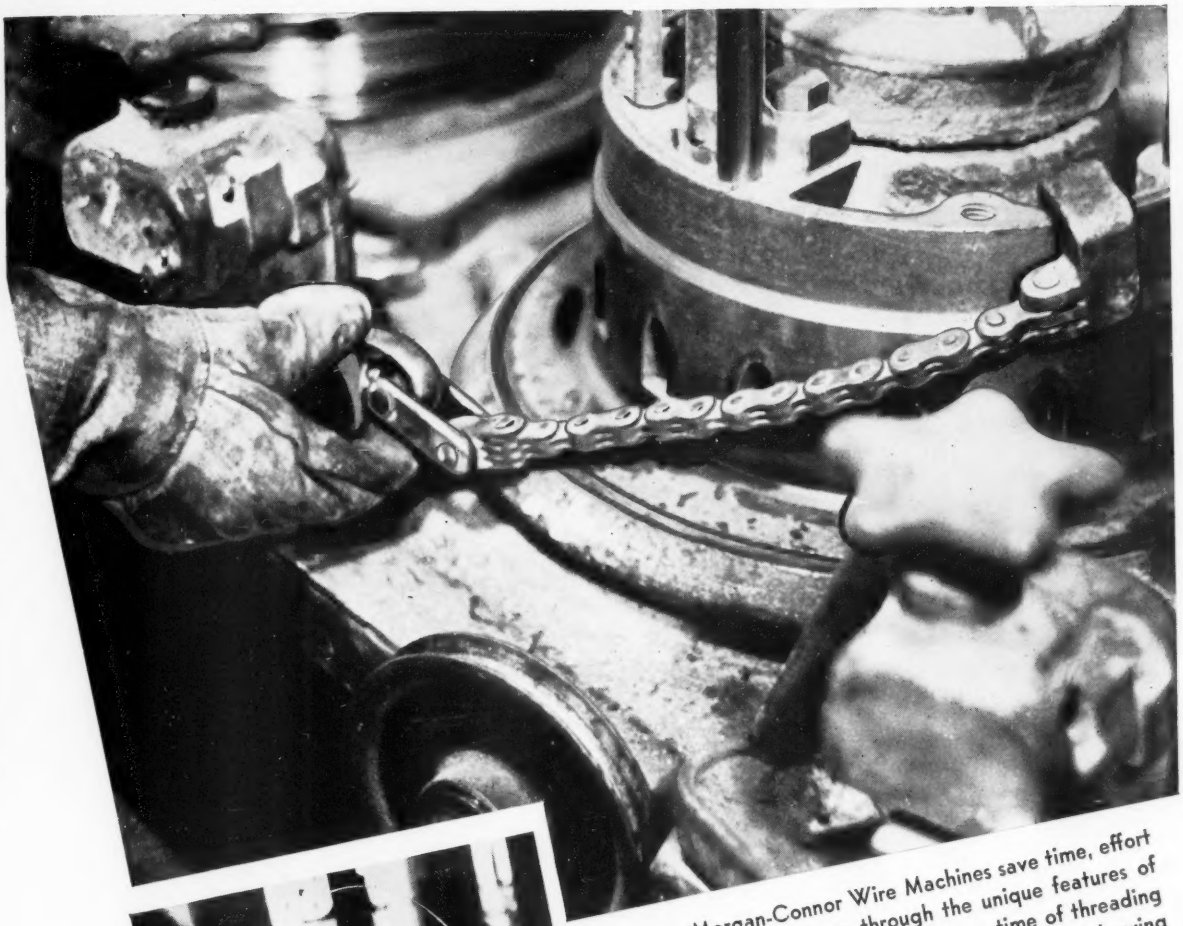
WIRE—Nickel Silver and Phosphor Bronze
Hudson Wire Co., Ossining, N. Y.
Seymour Mfg. Co., Seymour, Conn.

WIRE—Non Ferrous to Specification For Special Purposes
Hudson Wire Co., Ossining, N. Y.
Seymour Mfg. Co., Seymour, Conn.
Winsted Div. of Hudson Wire Co., Winsted, Conn.

WIRE—Spring
Keystone Steel & Wire Co., Peoria, Ill.
Youngstown Sheet & Tube Co., Youngstown, Ohio.

WIRE—Steel—Also Coppered Steel—Also Galvanized Steel
Keystone Steel & Wire Co., Peoria, Ill.
Republic Steel Corp., Cleveland, O.
Youngstown Sheet & Tube Co., Youngstown, Ohio.

WIRE AND STRIP—Zinc
Platt Bros. & Co., The, Waterbury, Conn.



● Morgan-Connor Wire Machines save time, effort and valuable space through the unique features of their construction. They conserve time of threading dies by butt welding, and permit high drawing speeds on both high and low carbon stock. Heavy production schedules are maintained with a minimum of effort. Compact design effects considerable savings in floor space, and the need for special foundations is eliminated. Morgan Construction Co., Worcester, Mass., U. S. A.

MORGAN-CONNOR

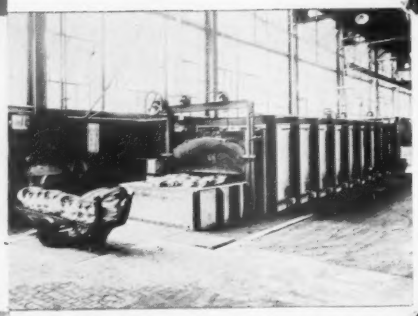
Continuous Wire Drawing Machinery

Sole European Representatives — Malmedie & Co., Dusseldorf, Germany

(Below) Gas fired, continuous conveyor type furnace for clean annealing brass and bronze wire in coils—capacity 5,000 lbs. per hour.

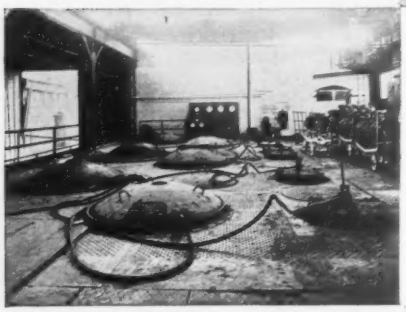
(Above) A special atmosphere continuous, roller hearth type electric furnace for bright annealing bronze, copper and nickel-silver wire and strip.

(Below) Three fuel fired pit type furnaces for normalizing and spheroidizing rod and bright annealing wire—another repeat order.

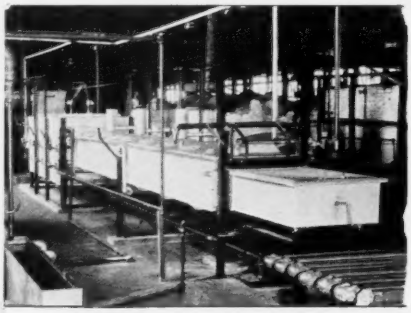


(Above) Special alloy rod is annealed without scale or decarburization in this electrically heated pit type furnace. One of several similar furnaces in a prominent plant.

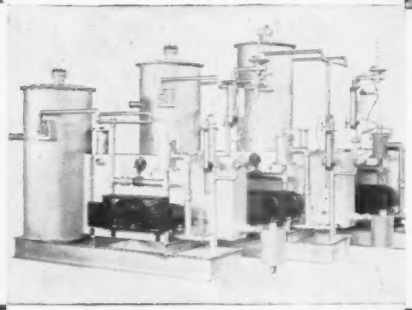
(Below) Bright annealing fine copper wire on spools — one of two similar controlled atmosphere installations we made in this plant.



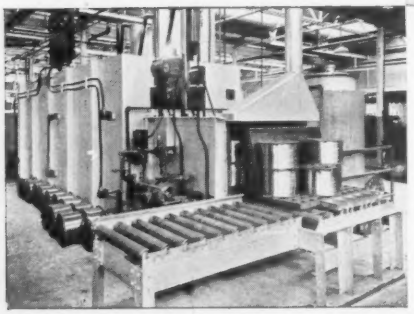
(Below) Three standard sizes of Elfurno generators for producing the inexpensive protective atmospheres used in controlled atmosphere furnaces. Elfurno generators are built for any capacity required.



(Below) A special atmosphere pusher type electric furnace for bright annealing both heavy and fine copper wire on large reels, on spools and in coils.



(Below) Another fuel fired, continuous, controlled atmosphere bright annealing furnace equipped with The Electric Furnace Company's new recuperative type gas fired radiant tubes.



We design and build oil, gas and electric furnaces and time and labor saving material handling equipment for use in connection with furnaces.

Put your furnace problems up to our experienced engineers.

The Electric Furnace Co., Salem, Ohio

Gas Fired, Oil Fired and Electric Furnaces---For Any Process, Product or Production